THE ELECTRICAL WORLD

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Electric Lighting.—XXX.

THE JAMIN CANDLE.

At the time the Jablochkoff Company came into existence M. Jamin, professor at the Sorbonne, Paris, was retained as consulting electrician by the company. He subsequently severed his connection with it, in order to devote himself exclusively to the study of improvements on the Jablochkoff candle. Like many others, he deprecated the use of the colombin, and his experiments were made with carbons separated by an air space only, as in the Wilde candle. In Mr. Jamin's opinion, one great disadvantage of the Jablochkoff candle was the projection of its light upward, as in nearly all cases it is desirable that it be directed downward. It was considered an objection that when used in street lighting this candle lights the atmosphere rather than the ground. Nevertheless, it was not expedient to invert it, as that rendered the light very unsteady, causing it to flicker incessantly. The heated gases and warmed air around the arc tend to rise, and in doing so produce air currents like those that "lick" the flame of a wax candle, and the arc is constantly displaced upward to one side or the other, which renders it unsteady. The same trouble is also common to the Wilde candle; if anything it is still worse, as the colombin of the Jablochkoff candle, by its incandescence, produces a vapor denser than that resulting from the incandescence and combustion of the carbon alone and not so easily disturbed by air currents as when less dense, as in the Wilde candle. M. Jamin studied various methods by which the arc could be maintained fixedly at the tips of the carbons. He accomplished this finally by taking advantage of the fact that parallel currents flowing in the same direction attract each other, or at least their conductors. We have already seen (in Electric Lighting XXI.) that the arc behaves according to this law, and that an arc placed near another, or near a conductor carrying a current, will be attracted when the currents in both parts are flowing in the

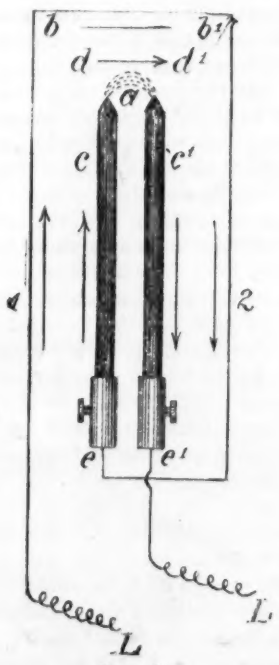


FIG. 94.

same direction and repelled when they are flowing in contrary directions. The principle of the Jamin candle diagramatically represented in Fig. 94 will now be readily understood. In this candle the conductor *L* forms a coil, or hank, around the carbons *c c*¹. The arrows show that the currents in the carbon *c* and the side 1 of the hank of wire are always in the same relative direction, and that such is also the case for *c*¹ and 2, as well as for *b b*¹ and *d d*¹. The current being alternate, the direction of the arrows would, of course, be reversed during every second impulse, but the relative directions of each couple would remain the same. It follows from this condition that as long as the current passes the carbon *c* will be attracted to the left and the carbon *c*¹ to the right and the arc *a*, instead of passing in a straight line between the tips, will be pulled upward and form an arch.

Fig. 95 shows an early form of the Jamin candle, the construction and operation of which will be readily understood. The wire is coiled into a hank, which forms the suspension brackets by which the candle proper is supported; and the ends of the wire also form the connections by means of which it is included in the circuit. In some cases the colombin was used and the carbons were connected at the tips by the plumbago mixture which completed the circuit in the Jablochkoff candle, but later the colombin and fuse were dispensed with, and the circuits were completed by the carbons coming into contact under the influence of a spring. The attraction caused by the current in the surrounding or "directing" coil, as it is called, was sufficient to move the carbons apart and establish the arc, which was sometimes attracted so quickly and powerfully by the magnetic reaction between it and the

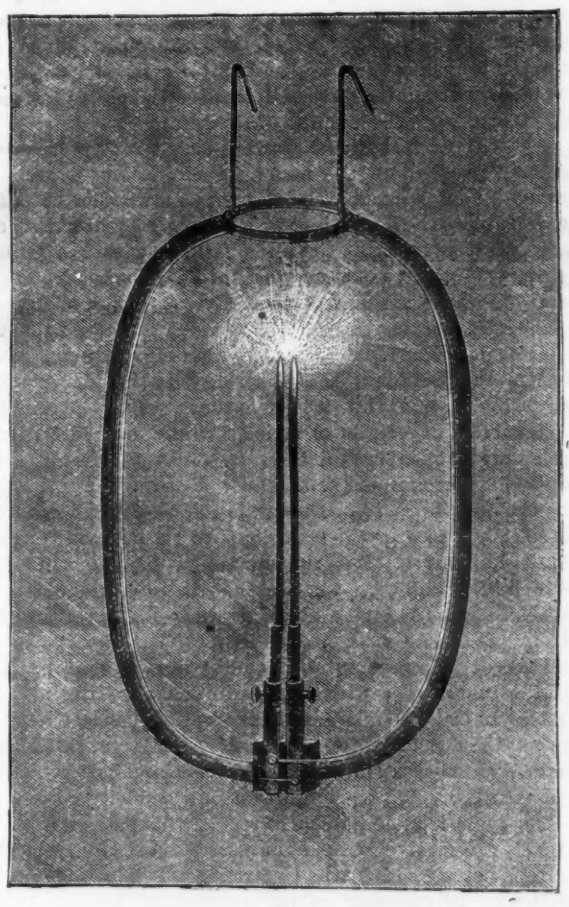


FIG. 95.

coil that it would become arched and break in two, thus opening the circuit.

Fig. 96 shows the latest form of the Jamin candle, which embodies some important modifications. The left-hand portion of the figure shows the candle, or more properly, the "burner" in side elevation, and the right-hand portion shows it in section. The directing coil *B B B* is in the form of a flattened hank wound in a grooved frame of thin copper, part of which is shown removed to expose the wire. The coil is flat and scarcely thicker than the carbons, as shown in the sectional view. This is done in order that the light from the candles inside the coil may not be too much intercepted, which would give rise to undesirable shadows. In each burner there are three sets of carbons, though the number is not limited to three, but may be varied in an installation as convenience requires. Only one set of carbons is consumed at a time, and the action of transferring the current to the next set is automatic, as will be seen presently.

The carbons are all held in clips on the ends of arms supported by a flat platform *A* of slate, ebonite or other insulating material. The arm to which the left-hand carbon *a* of each set is attached is pivoted so as to oscillate in the plane of the coil *B B B*, and can therefore move the carbon *a* into contact with the carbon *b*, or away from it, according to the case. The current passes through the coil *B B B* on its way to the candles, the three carbons *a a a* being electrically joined together, and likewise the three carbons *b b b*. At the upper portion of the coil *B B B* a piece of soft sheet iron *C* is bent over it, forming a kind of inverted U magnet, which becomes magnetic under the influence of the current passing in *B B B*. The flat armature *D* pivoted at one end can move up and down in response to the power of the magnet. Each of the arms holding the carbons *a a a* is connected with this armature and controlled by it; when the armature is not attracted it falls down by its weight and the carbons move into contact, but when it is attracted they move apart. The carbons *b b b* are held in clips on arms which can also oscillate, but not in the same plane. They tend to move at right angles to the others. A spring normally holds them out of line, as shown by the dotted lines in the sectional view. In this situation the carbon *a* would be unable to come into contact with the carbon *b* held in this clip; but when the carbon *b* is put in place a small wire hook is brought around it and fastened at the other end to an arm *H*, by which the carbon *b* is thus held in line in opposition to the spring. On passing the current, the armature is attracted, the carbons are separated and the arc is established. Now, if the carbons were all of equal length, each set would become separated at the same instant, consequently the current would be divided equally between the three sets. In practice, the sets of carbon are made of unequal length, therefore, only the longest set comes into contact, and at that set the arc is first established. When this set is almost consumed and the candle has burned down almost to the clips holding the carbons, the small wire hook which holds the arm of the carbon *b* in place is fused by the heat of the arc. Under the influence of the spring the carbon holder flies out of position; and as the contact cannot be re-established between it and its mate, the armature *D* falls down further and the next set of carbons is brought into play. After this the action proceeds as before. The course of the current through the coils *B B B* and the carbons of the first set is shown by arrows, and is precisely the same as shown in Fig. 93.

It will be understood that the arc would be attracted and caused to bulge downward in this case, and on this attraction M. Jamin depends to counteract any tendency of the heated gases to push the flame upward on either side, and to make the stability and fixedness of the arc greater. At first Jamin used only six coils of wire in the coil *B B B*, but finding the magnetic attraction on the arc insufficient, he gradually increased the number of turns to 40.

Contrasted from a mechanical point of view with the Jablochkoff, the Jamin candle presents several points of superiority. First, while in the Jablochkoff candle it is necessary to have a separate leading wire for each candle used, the Jamin necessitates only one circuit for all the candles in the same burner. Secondly, in the Jamin candle no switch is required to transfer the current from one candle to another, because this is done automatically. We have also the advantage that obtains in the Wilde candle, viz., that if interruptions occur during use, each candle will relight itself automatically and thus be completely burned. The light is also free from the play of colors noticeable in the Jablochkoff candle, and it also has the great advantage that it can be burned inverted as well as the other way. M. Jamin at one time tried the use of a mechanism intended to make the carbons follow synchronously by slight movements the undulations of the current, with the expectation of utilizing the latter to better advantage, but the idea did not prove practicable, and the mechanism produced such a disagreeable vibratory noise that its use was abandoned.

Strange as it may seem, this candle has not proved so successful in practice as the Jablochkoff. It presents several points in which it appears to be inferior to that, and these have been the main reasons why it has failed to become adopted very extensively in electric light installations. Though the candles will burn inverted, yet their

light is not as steady as that of the Jablochkoff, and this appears to be due to the absence of the colombin. While the use of the colombin is attended with the great disadvantage of producing colored rays, yet there are undoubted advantages incident to its employment in electric candles. Experiments made by the Jablochkoff Company in Paris, expressly for the purpose of determining the usefulness of the colombin, have proved this fact conclusively. They showed that the light was incomparably steadier, and although not more intense, it required much less power than when the colombin was absent, doubtless because the dense vapor of the arc using a colombin is of lower resistance and will permit more current to pass in a given circuit. The colombin has accordingly been associated ever since with the economy of the Jablochkoff candle; and probably the fact that the Jamin candle has not proved so economical of power can be accounted for by the absence of the colombin. Besides this, it should be borne in mind that the coils of wire wound around the Jamin candle represent a considerable proportion of the circuit resistance, and in a circuit of several candles this coil resistance is equivalent to one or more Jablochkoff candles.

THE DEBRUN CANDLE.

Among the improvements in the Jablochkoff candle which deserve mention as presenting features of special interest is that of M. Debrun, of Bordeaux, France, which appeared about the beginning of the year 1881. This

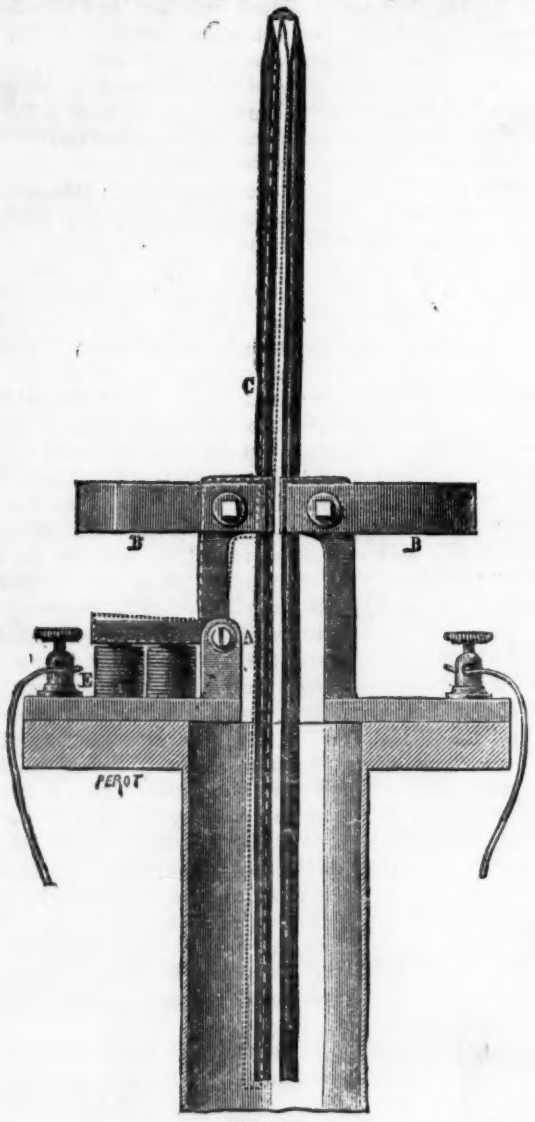


FIG. 96.

candle is of the same class as that of Wilde and Jamin, insomuch as it dispenses with the colombin. In this lamp, however, the carbons never come into contact to close the circuit. They are held fixedly apart, being separated by a small air space of about three millimetres. The manner in which the circuit is closed between the carbons is very interesting. When there is no current passing, a small stick of carbon touches both of the candle carbons at their base near the clips holding them and closes the circuit between the two candle carbons. It is attached to an arm of a lever which forms the armature of a magnet placed in a derived circuit of the arc. As soon as the current is put on the magnet attracts the lever, and the stick of carbon leaves contact with the candle and the arc is established near the base of the carbons; but as parallel currents moving in contrary directions repel each other, the arc instantly climbs up to the tip of the candle and remains there until it goes out. As often as the light goes out the candle is relighted again in the manner just described, and as the carbon stick makes contact with the carbons at the base, it is evident that the lighting device may be made to work as long as any of the candle remains to be burned. This candle has proved quite successful in Bordeaux, where it has been introduced in several installations. It does not appear, however, to be very superior to the Wilde or Jamin candle in point of steadiness.

C. O. M.

Electricity and Uniform Time.

The *Mail and Express* of this city says that a wealthy citizen of Mauch Chunk has made a novel bequest to that town, of such utility that it deserves to be made known throughout the entire country. He has provided an electrical attachment by which the time of the clock in the telegraph office of the Lehigh Valley Railway is struck on one of the large bells of the chime of St. Mark's Church, and as the telegraph clock is regulated at noon daily, it is very easy for all the people of Mauch Chunk to have their time-pieces correct. A time-ball has also been placed on the church, and it drops at precisely noon, after the manner of the time-ball on the Western Union building in this city.

A similar attachment might advantageously be provided to strike the correct time in every town in the Republic which has a telegraph office. Costly town clocks can not be provided in many of the smaller villages, but the hours may be struck on church bells without costly clocks, if the Mauch Chunk electrical apparatus be employed. It will be a great convenience to a large part of the population of the entire country to have the time of the telegraph clocks struck on the bells nearest to them, and when a uniform system of time for the world is adopted, by means of electricity the clocks of each meridian can easily be made to tick in unison.

A New Lightning Arrester.

Among the visitors that now and then take it upon themselves to call around and examine the precincts of a telegraph office or a telephone exchange, none is more apt to come on the wrong day and when not wanted than that eccentric genius, lightning. It seems to delight in calling when seclusion is most agreeable to the inmates of these places, and to waive all formalities without regard to the comfort of the host. In fact, so unpleasant are these nomadic incursions of the freaky fiend apt to prove, that a sentinel is kept on duty to scout his approach and close the doors against him. This sentinel, technically known as the "lightning arrester," is, unfortunately, not as vigilant as might be desired, the fiend often eluding his grasp and pouncing upon the company unawares. It is a fact, and a sad one, that there is as much need of reform in lightning arresters as in the police department of our cities. Not one in a dozen of the "arresters" will "arrest" when it should. Improvement after improvement has been proposed. The lightning arrester has been changed and remodeled many times, but the "discipline" has always proved ineffectual, and still the arrester continues to be recreant to the duty of defending the places intrusted to its care from the assaults of lightning.

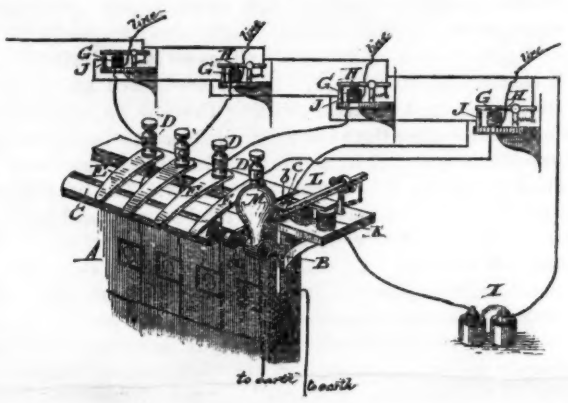
The various forms of lightning arresters now in use are all constructed on the same principle. The simplest is made by screwing a strip of brass to a wooden base, and then sawing the brass into three nearly equal pieces, and afterward connecting the middle piece with the ground wire, and the two outer pieces with the wires leading in and out of the station, respectively. When a charge of electricity, coming from the atmosphere either in consequence of a lightning discharge or from some other cause, enters the building, the electricity finds itself separated from the ground wire at the arrester merely by a small slit.

A current of voltaic electricity would not jump across this narrow opening and then pass into the ground without going through the relay and out of the building again by the outgoing wire. Its tension or electro-motive force is too slight to urge the electricity to leap across even this limited air space. But the electricity of the storm cloud, which has such high tension that it can bridge the air space between a cloud and the earth, is capable of jumping from one of the outer or wire strips of the arrester to the middle or ground strip as it comes into a station. This is the manner in which the ordinary lightning arrester acts. In order to facilitate the escape of the electricity between the outer and the middle arrester strips, the former have their edges serrated like a saw, sharp points rendering the escape of high tension, or static, electricity easier.

The great trouble with arresters of this pattern is that if the electro-motive force of the electricity discharged on the wire is not very high, the electricity will experience some difficulty in escaping to the ground by leaping to the ground strip. It may seem at first paradoxical that the electro-motive force of the static electricity in a telegraph wire can be less when once it strikes the wire, but the fact may be explained.

The total electro-motive force of the electricity of the storm cloud before the discharge represents the difference of electrical tension of charge, or potential between the earth and the cloud. The function of the discharge is merely to equalize the two potentials by transferring a certain volume of electricity from the higher to the lower. Now, if a lightning discharge takes place from a cloud to the earth and only a small part of it is conveyed by the wire, what is the consequence? The larger part of the electricity having escaped to the ground, the potentials become equalized to a great extent, and the difference of potential between the electricity on the telegraph wire and that of the earth will now be much smaller, consequently the electro-motive force of this electricity will be much lower. The effect of this change is that when it comes into the station, instead of passing entirely away by leaping to the ground at the arrester, it will partly or entirely pass through the office circuit. Once it finds its way there the consequences are hard to foresee. It may take a fancy to play capers of all sorts, without the least regard for the comfort of the operator or the safety of the building, and it is difficult to say how soon or through what route the streak will choose to depart. The only expedient at hand for operators who do not relish the unwelcome visitor is to insert a plug between each outer strip and the middle strip of the arrester, and thus make "assurance doubly sure." But here let us say a word about ground connections. In justice to the arrester we must admit that it is not always at fault. Sometimes even a plugged arrester will not suffice to prevent the ingress of the lightning discharge. Why? Simply because the ground wire of the arrester is too small to carry all the electricity of the discharge to the ground. In some cases it has been known to melt, even as an electric light wire does when the generator is short circuited and the volume of current passing becomes too great. On general principles it may be laid down as good practice to use as large wire as possible, and as many strands of it as convenient. The total thickness, or, in other words, the body of metal forming the conductor from the lightning arrester to the ground, should be large enough to convey powerful charges of electricity to the ground without melting or even without being unduly heated. The ground connection of a lightning arrester constitutes a lightning rod, in fact, and it should be as large as a lightning rod. There is no danger in making it too large, but there is danger in making it too small.

With a good ground connection and the arrester plugged as suggested above, the immunity from danger must be well-nigh complete. But now what is needed is a contrivance by means of which the plugging will be done automatically, as in many cases the damage in a telegraph office occurs during the night, or while there is nobody there to take this precaution.



THE AHEARN LIGHTING ARRESTER.

Considerable inventive effort has been directed to the accomplishment of this purpose, but in nearly all cases the apparatus does not appear to have been reliable in the performance of its functions. We illustrate herewith a new lightning arrester, invented by Mr. Thomas Ahearn, of Toronto, which answers this purpose in an effectual manner, not only for one line, but for every line running into an office, if desirable. It is an ingenious and complete device, which all telegraph and telephone people will be interested in. Four lines are represented in this illustration. Where the lines enter the building they go to binding posts *D D D*, from each of which extends a metallic finger or strip *E*. These fingers press on a metallic roller, or cylinder *C*, which can revolve on a shaft and is in metallic connection with the ground. A portion of the cylinder is covered with varnish, paper, or other insulating material, as shown by the white space in the figure. In the position represented the springs *E* are kept from electrical contact with the cylinder. It is evident that by turning the cylinder partly around, however, the bare metallic portion of the cylinder will come under the fingers *E*, and will ground every line. The shaft of the cylinder has a thread, so that by turning it around a few times a fresh portion of the cylinder may be brought in contact with the fingers. The shaft has a weight *M* attached to an arm in such a manner that when left to itself it would fall and cause the rotation of the cylinder. This rotation is prevented by a hooked lever *b* fastened to the shaft, and held by the hooked end *c* of the armature *L* of an electro-magnet *K*. When this armature is attracted by the electro-magnet, the hooked lever is released and the cylinder turns. All that is necessary, therefore, is to cause the magnet *K* to act during a storm in order to cause every line to be automatically grounded. This is easily accomplished in the following manner: Each line as it comes into the building passes through a small electro-magnet *G*, whose armature on closing can cause a local circuit *J* to close, which includes the electro-magnet *K*. The armature of each of these small electro-magnets is held back by a spring of such tension that the usual telegraphic currents will not cause its motion; but it moves whenever an excess of current, as from atmospheric electrical disturbances, enters on any wire. As soon as this happens the local circuit is closed and the current diverted through the electro-magnet *K*, and the armature *L* moves so as to release the hooked lever holding the cylinder, which immediately turns and grounds every wire in the office. If desired, a few cells of battery may be included in the local circuit, as shown in the figure, in order to make the action of the electro-magnet *K* more certain. It will be seen that in this arrester the protection is double. In the first place, as it stands it is as good o

perhaps better than the ordinary arrester, because the fingers *E* are only separated from contact with the cylinder by a thin space equal to the thickness of a sheet of paper, which the lightning can easily perforate in most cases. The second protection is in the fact that as soon as a discharge takes place on any one wire the others will be automatically grounded, and thus the whole office is at once made secure against further danger. In many offices the work cannot be interrupted, even during the severest storm. In such cases the cylinder must be locked in place, and the escapes of current allowed to take place through the paper on the cylinder. But at night, when the office is unoccupied, the convenience of the appliance is undoubtedly very great, especially so since damage from lightning often occurs during the night.

It is plain that the principle of the invention can be varied at pleasure to suit particular cases. Instead of using insulation, for instance, the surface of the cylinder may be flattened, so that the contact fingers will not touch but will be divided by a slight air space. Instead of the weighted lever *M*, a spring can also be used, and it is plain that the cylinder may be made sufficiently long to accommodate any number of lines. Altogether the device looks entirely practical and applicable to telegraph and telephone circuits, and it seems to us that wherever it is adopted it will make an arrester that *will* "arrest."

Electric Gas-Lighting Devices.

Now that we have had a taste of the incandescent electric light and are familiar with its many superior merits as an illuminant, there is scarcely one of us who would not welcome with satisfaction its complete substitution for all other kinds of light. However, before we reach this millenium, many questions—technical, industrial and economic, all more or less important and intrinsic—must be answered. For the present, then, and indeed for an indefinite time, while the solution of these problems is pending, we must content ourselves with gas. Lighting by gas seems likely to still have considerable of a lease of life, and this lease will be yet longer if inventive effort only continues to add to it that greater perfection, greater economy and convenience which will tend to place it on a level with the electric light.

In the last few years the question of obtaining a more economical light from gas has received considerable attention from inventors, and many improved burners have been produced by which the light production of a given amount of gas is greatly increased. Much remains to be done yet, however. After we have succeeded in making the gas-light economical, we must make it convenient. In fact, in many cases convenience is the paramount consideration. It is especially in this respect that the electric light excels; all that is necessary is to turn a switch or press a button, and behold, there is light! When we contrast this with gas, and recall the inconvenience, the annoyance and indeed the possible dangers incident to the present method of lighting it, we feel that something ought to be done by the way of improvement in this direction. As a matter of fact something can and has been done by calling electricity into requisition in the construction of devices for lighting gas, and we propose to describe a few attempts made in this direction. We have lately examined the various kinds of electric gas-lighting apparatus made by the Electrical Supply Company, New York, for the Electric Gas-Lighting Company, of Boston, which makes a specialty of devices of this kind.

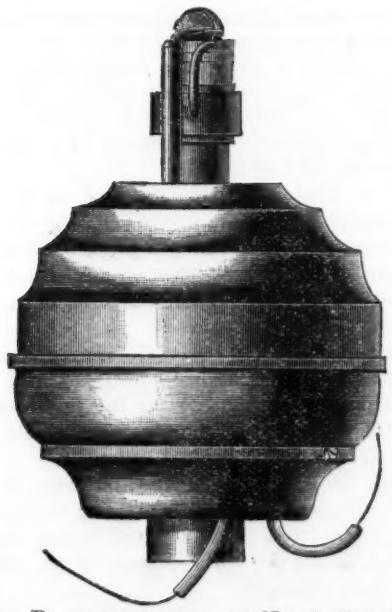


FIG. 1.—RATCHET AUTOMATIC NO. 1, FULL SIZE.

The problem to be solved in a device for lighting gas is simple enough. There are only two objects to be attained, namely: To turn the gas on or off, and to ignite it. The first may be done by hand, as ordinarily, or else by means of electricity, acting upon a suitable mechanism. The second requires the production of a spark of electricity in the gas after it is turned on. Many inventions have been produced, having either or both of these objects in view, but the difficulty with them in most cases arises from too complex construction and liability to frequent derangement. In this respect the apparatus of the Electric Gas-Lighting Company appears to be quite superior, its simplicity of construction and precision of working being noticeable features.

In some of the electric gas-lighters the gas is turned on by hand, the same motion producing the electric sparks that ignite the gas. In others the whole operation is done automatically by electricity, and thus the light can be controlled from a push-button placed at a distance, just as is the case with annunciator bells. We will first describe the automatic lighters. Fig. 1 is a full size illustration of one, and is adapted to be used in private residences, stores, banks, offices, etc. The mechanism is concealed inside the globular case around the burner, containing an electro-magnet connected by two wires to a battery. Attached to the armature of this electro-magnet is a pawl, which engages the teeth of a ratchet-wheel fastened to the spindle of the stop-cock of the gas jet. The armature also carries an arm, which is prolonged upward through the casing. This arm is provided with a metallic point, which makes contact with another point near the tip of the burner. The current passes through this arm and through the contact, in order to complete its circuit. Now, suppose the current is put on by pressing a push-button at a convenient point; the armature is immediately attracted, in spite of the spring which holds it back. As it moves its pawl engages the ratchet-wheel causing it to move, and the vertical arm also moves out of contact, producing a spark and at the same time opening the circuit. Immediately the armature falls back again, and as the circuit is again completed by the return of the vertical arm, it is again attracted. The result is

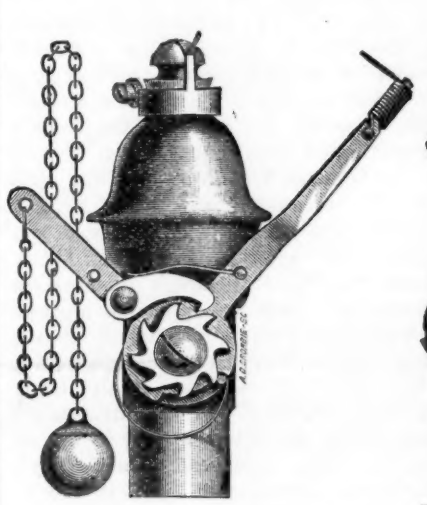


FIG. 2.—BOSTON PENDANT BURNER NO. 2. FULL SIZE.

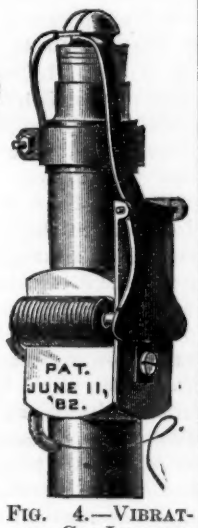


FIG. 4.—VIBRATING GAS LIGHTER NO. 5, FULL SIZE.

that the armature vibrates to and fro, exactly as the armature of a call bell, causing a spark at each motion and moving the ratchet wheel one tooth, and consequently the stop cock until it is finally open, and the gas issuing is at once lighted by the sparks produced near the burner tip. The operation of lighting is so brief and rapid as to be almost instantaneous. A commutator automatically opens the circuit when the gas is lighted, in order that the battery may not be kept on closed circuit too long. While the gas is burning if the push-button is pressed, again the armature vibrates as before, and the stop-cock keeps turning in the same direction until the gas is shut off, after which the commutator agains opens the circuit as before. The necessity of such a commutator is apparent, as without it the continuous pressure of the push-button would cause the current to remain so long that the armature would cause the stop-cock to move too far, and thus in lighting the gas the stop-cock might turn more than half way and partly shut it off, while in shutting it off the motion might be such as to turn it on again partly.

The company manufactures another type of automatic lighter in which there are two electro-magnets, one on either side of the gas-way, which govern a lever by an armature. When an electric current is sent through one magnet the armature is attached to that magnet and the lever turns the stop-cock and lets on the gas. At the same instant the armature comes in contact with the current-breaking lever, the electric circuit is broken at the burner tip and the sparks ignite the gas. When the current is sent into the other magnet the armature is drawn to it, and the reverse motion of the lever causes the gas to be shut off.

It will be understood, of course, that in every case the battery and the push-button may be located at any convenient place. In a private residence the hallway lights might be controlled by a push-button placed in the sitting room or in the sleeping apartments. The gaslights in the cellar, or the pantry, etc., could likewise be lighted from the kitchen.

In cases where the building is protected by a burglar-alarm, connection with it and the gas-lighting system may be made, hence any attempt to open a window or a door will light up the apartment or the whole building at the same time that the alarm is sounded.

Among the uses to which the automatic lighter is well adapted may be mentioned the control of street lights and the lights in public buildings. It has been tried with great success in Salem, Mass., and other places, on street lights connected by a wire and controlled from a central station at will. The system is said to be highly satisfactory for this purpose, and materially reduces the expense which every city pays for the work of lighting. If the moon begins to shine at night the lights can be all extinguished at once. If, however, that luminary proves recreant to her duty and hides behind a cloud, then the city can be instantly lighted again in less than a minute's

FIG. 3.—PENDANT BURNER NO. 2 IN OPERATION.

FIG. 5.—OPERATION OF VIBRATING BURNER NO. 5.

notice, a feat which would be impossible by any other arrangement. This advantage alone should make the system valuable to cities.

The company also makes a full variety of the hand lighters used in places where the automatic lighter is unnecessary, and where the use of matches is undesirable or prohibited. In private residences, for instance, some expense may be avoided by using the hand lighter, which is cheaper, in sleeping apartments, dining-rooms, etc., where the automatic lighter is not of any special convenience. A form of hand lighter extensively used is that known as the "Boston pendant burner." (Fig. 2.)

The stop-cock carries an eight-tooth ratchet-wheel, which can be moved by a pawl attached to one arm of a bell-crank lever. On pulling the pendant (Fig 3) the stop-cock, which has four gas ways through it, turns so as to let on the gas, while the long arm of the bell-crank lever moves, and the projecting end of a spiral spring at its extremity touches a wire fastened to the burner tip and closes the circuit for an instant, only to slip past and open it again, thus causing a spark which ignites the gas.

An interesting modification of this device, known as the "vibrating gas-lighter and burner," is shown in Fig. 4. It contains an electro-magnet whose armatures vibrate as it makes and breaks the circuit near the burner-tip, exactly as in the automatic lighter first described. The gas is turned on by hand in this case (Fig. 5), and as this is being done a push-button is pressed upward, as shown in the figure, closing the circuit and causing the armature to vibrate and produce the succession of sparks at the burner-tip which ignites the gas.

Fig. 5 shows how the pendant lighting devices can be adapted to the ordinary Argand gas-burner. All that is necessary is to make the connections with the battery by small wires, which may be concealed in the burner and tubes.

The advantages of these lighting appliances are so evident that it is unnecessary to enlarge upon them. Their sphere of usefulness must be extremely large, as there is scarcely a place in which gas is used where they will not recommend themselves. They supply a universal existing need, and it is pleasing to observe how simply and yet how perfectly electricity is adapted to its part of the work. This is but another proof of the fact that there is a whole mine of minor industries where electricity can be brought into use to prove a source of convenience to the public, while at the same time it may prove a source of profit to the inventor who has turned his efforts in that direction.

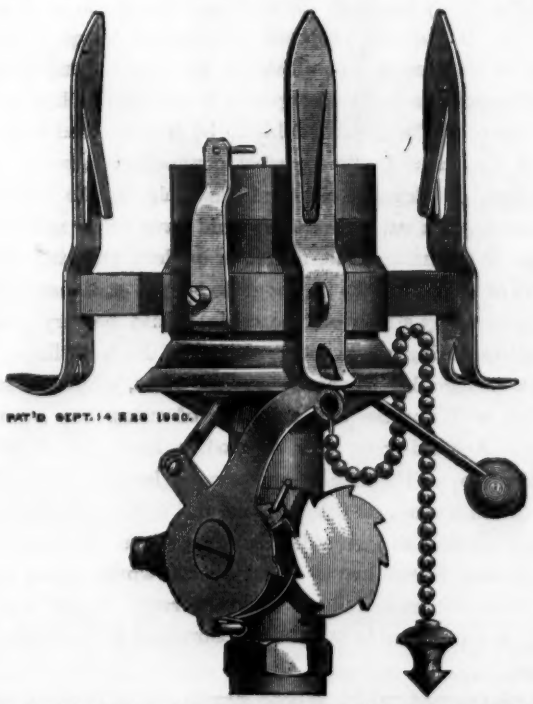


FIG. 6.—RATCHET ARGAND BURNER NO. 6, FULL SIZE.

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TELEGRAPH SIGNALS FROM MID-OCEAN VESSELS.

The transmission of telegraph signals from ships in mid-ocean to the shore would be a great convenience, and considerable study has been directed at various times to the subject. It has been proposed to establish telegraph stations in mid-ocean, and although the undertaking would entail enormous cost and expense, it has been looked upon with favor. The great trouble to be apprehended in such a case is in maintaining a perfect connection between the "station" or telegraph ship and the cable on the bottom. The connection with the cable would have to be made by means of a branch cable, and it is evident that the difficulties of anchoring the ship so as to keep it stationary, and to prevent any strain on the cable, would be very great, especially during rough weather. Prof. E. A. Dolbear, of Tuft's College, has proposed an expedient, which, if successful, will obviate the necessity of using the branch cable. According to this method, a large metal plate attached to an insulated conductor is lowered from the ship to the bottom on the track of the cable, and another plate is merely submerged. Between these two plates a battery and Morse key is inserted. On working the key the Morse currents induce other currents in the cable, which can be heard in telephones connected to the cable on shore.

By this means, which is both simple and ingenious, any ship in mid-ocean, finding itself in the track of a cable and having the necessary apparatus, could signal with the cable stations on shore. It would be an easy matter to provide the ship with a cable chart, showing the locality of every cable, and a code of conventional signals could easily be agreed upon the world over, by means of which a vessel in mid-ocean, in any part of the globe where there is a telegraphic cable, can be put in telegraphic communication with the shore.

Important if True.

A special dispatch to the St. Louis *Globe-Democrat*, dated Washington, June 28, states, on what it calls high authority, that Mr. McDonough is to be awarded the patent for the telephone receiver in general use. The interference case in which is involved the right to the telephone receiver has, as readers of THE ELECTRICAL WORLD are aware, been pending in the Patent Office for several years.

The parties in the case are James W. McDonough, of Chicago, Messrs. Bell, Edison, Gray, Voelker, and several others. The Washington correspondent of the *Globe-Democrat* understands that the decision has been rendered, but that it is being surreptitiously printed to avoid publication before it is officially promulgated. It is stated, however, he adds, upon pretty high authority, that Mr. McDonough will be awarded the patent for the telephone receiver. The other inventors will each be awarded a proper share for their respective improvements. The decision is based upon the following facts, said to have been established by the verdict in the case: Mr. McDonough is the first one in this country who made a telephone receiver having a magnet coil and diaphragm, which he constructed in 1869. He is also the first one who made the telephone transmitter, which he constructed in 1874. He applied for patents in the spring of 1876, and called his combination of instruments the "telelogue," which means "for speaker." Mr. Bell invented his speaking telephone in 1876; Mr. Gray invented his receiver in 1875. The other inventions were made subsequent to this time. McDonough's application was in the Patent Office some time before Bell made his application for a patent on his telephone system. In the spring of 1876 Bell obtained a patent for multiple telegraphy, but this patent did not disclose a speaking telephone. In a recent suit in England, brought by the Bell Telephone Company against infringers, the Lord High Chancellor decided against this company, holding that Bell's patent of 1876 did not disclose to the public the principle on which the speaking telephone is constructed. The celebrated Englishman, Prof. Thompson (presumably Sir William Thomson), was the chief witness in the case. He, it is said, testified that Mr. Bell told him in this country, in 1876, that he had never succeeded in talking with his instruments patented that year, and it is claimed that Mr. McDonough remains the first man in the United States who has applied for a patent on details without which the speaking telephone could not have been constructed. It is alleged that the controlling instrument in the telephone is the receiver. As the transmitter, almost exactly as now used, was the invention of Philip Reis, of Germany, in 1861, a full history of the invention of the telephone, from its suggestion in 1847, by a German, to its subsequent improvement by Reis and its final development by McDonough, as well as the history of the telephone business in this country from its inception to the present day, will be fully outlined in the forthcoming decision.

This is what the *Globe-Democrat* correspondent has to say of a matter in which electricians are deeply interested. Holders of Bell telephone stock will probably, however, not dispose of it at a sacrifice until something more definite is at hand regarding the alleged decision in Mr. McDonough's favor.

The Postal Telegraph Company's Expectations.

If the Postal Telegraph Company successfully carries out all its plans it will be the most important factor in telegraphic business that has yet appeared. Its officers assert that it will be ready to send messages between this city and Chicago in less than two weeks. That line has two compound wires. The company claims that with the appliances already in operation it can handle as much business as any existing company can on a line of twenty wires. Vice-President Cummins says his company will be able to do business without delays on account of foul weather, and at about half the prices asked by rival companies. The lines are being extended to all the principal cities in this country as fast as poles can be set and wires strung. During the last two months the Postal has had electricians testing new systems and appliances continuously between here and Chicago. The capacity of the wire is estimated at 1,000 words per minute. Press dispatches will be given unusually low rates. Mr. Cummins says that no business has been transacted so far, because the company desired to thoroughly test a line of 1,000 miles of a single circuit without repeaters and a very small amount of battery.

It is proposed to build trunk lines to all the large cities and transact business on circuits. In addition to the automatic service now in operation and capable of handling over 1,000 words per minute on a single wire in Morse characters, several instruments are being constructed which have been perfected for automatically printing the dispatch, by which they will be able to transmit 500 words a minute to Chicago, delivered, printed and ready for distribution at the receiving end. The rate from here to Chicago has not yet been fixed, but it will not exceed 25 cents for twenty words, and one cent a word in addition on day messages, which is much less than Western Union charges on the same distance. Provisions are being made for the organization of local telegraph companies in the more important Western States, to be feeders to the Chicago line, and offices are to be distributed throughout New York City. By means of certain patents, which the Postal Company has the sole control of, it will be able to transmit the message from a local office direct on to the Chicago wire at the main office, and thence to its destination, avoiding the expense and also the delay of copying out and re-telegraphing the message as at present.

It has also a contract with the American, British, and Continental Cable Company, by which it will transact all the land business for that company, and the latter receives all the messages of the Postal Telegraph Company for transmission across the Atlantic. By the terms of this contract neither the Cable nor Postal Company can consolidate with any other telegraph or cable company, or "pool" earnings with any other company for the period of ten years. This is intended to prevent absorption and to afford the public the benefit of the cheap rates produced by healthy competition.

The Vice-President says the inducements the Postal Company can offer will be greater facilities, quicker time and lower rates than any competing company; and he is of the opinion that the public will appreciate the opportunity of being released from the clutches of a grasping monopoly. The authorized capital is $21,000,000 and the cash capital will be $10,000,000. Of the latter amount $3,000,000 have been paid in, and with this money the company has constructed the line.

Telephone Consolidations.

We learn that the Rocky Mountain Bell Telephone Company, only recently incorporated, has quietly secured a large and valuable territory for telephone business. The Western men are well known to be liberal patrons of convenience, and the telephone business in the territories enjoys a more liberal patronage and better rates than can be obtained elsewhere in the United States. The recent purchases of this company were Salt Lake City, Park City and the Territory of Wyoming. The company now owns all of Idaho, Montana, Wyoming and Utah Territories, east of the 32° line. It has 10 exchanges in operation, with about 200 miles of connecting lines, and it is expected that fifteen exchanges will be added to the list this year. The energy and financial success of this company is due almost entirely to Messrs. J. J. Dickey, L. H. Korty, A. J. Pattison and W. B. Hibbard, the directors and principal stockholders in the company, and gentlemen who have no reputation to earn in the telegraph ranks.

Regarding the consolidation of the Northwestern, Southwestern and Erie Telephone Companies, Mr. Loren Downs, general manager of the companies under the control of the Lowell syndicate, says that the plan contemplates the formation of a company with a capital of $5,000,000, under the name of the Erie Telegraph and Telephone Company. There will be 50,000 shares of $100 each, divided as follows among the present stockholders: Erie, 15,000; Northwestern, 13,000; Southwestern, 20,000; with 2,000 shares in the treasury. The treasury stock will not probably be sold much, if any, below par. Besides this there are now in the treasuries of the several companies between $200,000 and $300,000. Thus it will be seen that the proposed new company will have nearly half a million in the treasury. The object of the consolidation is economy in running expenses, construction account, purchases, etc., and the convenience of executive offices, etc. The basis of consolidation will be the present ability of the companies to earn five per cent. dividends. The capital of the Erie will be put into the new company at $1,500,000, and it earned over $6,000 last month.

"Blocks" of Erie, which were placed at $22,500, will take 375 shares of stock, with a par value of $37,500, and those best acquainted with the prospects believe that the stock will go to the vicinity of $80 per share very soon.

The business of all the companies is in a most flourishing condition, and the promise for the future is great. The Southwestern company has already some 3000 telephones in use, and orders for 500 additional ones. Besides this, the company has arranged for the building of 1000 miles of extra territorial lines, which, it is believed, will pay a profit of at least 40 per cent.

Everything connected with the business is in good shape, new and improved apparatus having been put in, the lines nearly all built on poles, and everybody anxious for the telephone, where the rents average 40 per cent. above the rates in New England.

The Northwestern is putting in new stations at the rate of 250 per month. The river towns down as far as Winona are being connected, and a line is being constructed from St. Paul to Stillwater. Fifteen new wires have been built between Minneapolis and St. Paul, and orders for new stations come faster than they can be filled.

The Erie comprises the whole of Cuyahoga county, in which is the city of Cleveland. The franchises and rights of way here cannot be surpassed in the country. There are now 1500 subscribers, with some thirty applicants, who are increasing at the rate of two or three per day. About 1000 of the subscribers pay $6 per month, and the other 500 $5 per month. The cost of running is less than $20 per annum for each station. From present indications it is proba-

ble that the consolidation will go through without any opposition.

The consolidation of the companies was effected at a meeting of the stockholders of the Northwestern Telephone Company at Lowell on the 30th ult. A vote on the question of consolidation resulted in favor of consolidating by about 10,000 to 800. The directors of the Erie and Southwestern systems voted unanimously for consolidation.

A telegram from Chicago says that the Central Union Telephone Company, recently licensed under the laws of Illinois, and operating under the American Bell Telephone Company, of Boston, on June 28 purchased the property of the Midland, Western and Central Telephone companies, embracing the States of Ohio, Indiana, Illinois and the principal towns in Iowa. The directory of the new company consists of Anson Stager, R. C. Clowry, George L. Phillips, D. H. Louderback, Norman Williams, Theodore N. Vail, W. H. Forbes, John F. Wallick, William Renwick, George H. Twiss and M. G. Kellogg. The new corporation controls the greatest number of exchanges and subscribers, and owns the greatest number of miles of wire connecting cities of any in the United States.

A new telephone company has been formed at Davenport, Ia, to be known as the Iowa Union Telephone Company, and to operate only in that State. Among the promoters of the enterprise are W. H. Forbes, Theodore N. Vail, Geo. L. Phillips, of Boston; Anson Stager, W. C. Clowry, Norman Williams, John L. Thompson, D. H. Louderback, F. H. Tubbs and others, of Chicago; James Thompson, W. H. Decker, F. H. Griggs, G. W. Cable, W. A. Leary, of Davenport. Capital, $2,000,000. The company will embrace the greater portion of the State, both for exchanges and by lines connecting towns.

The Mutual Union at Last Defunct.

On Thursday last the New York Mutual Telegraph Company filed a certificate in the county clerk's office increasing the capital stock of that company from $25,000 to $2,500,000. As the name of that company had not before appeared before the public, this event excited considerable wonderment. Inquiry developed the fact that the office of the New York Mutual was the same as that of the Mutual Union. It is stated that there was a suit pending on the part of the people of this State against the Mutual Union Company to annul its charter, on the ground that it had violated it in raising the stock from two millions to ten millions of dollars. To avoid the expense of litigation and voluntarily do what the State was seeking to compel it to do it had been resolved by the Mutual Union, with the consent of all its stockholders, to pass out of existence. The New York Mutual Telegraph Company was organized with a paid-up capital of $25.000. and the following Board of Directors chosen: Wilson Godfrey, John H. Walker, William York Adler, George L. Record, David B. Waters, Charles G. Hedges and Henry P. Johnes. The new company made a deed or agreement with the Mutual Union to purchase its property and franchises, subject to the mortgage on it, and the Western Union lease, agreeing to give one of its shares, at a par value of $25, for one of the shares of the old company, the par value of which is $100. As $10.000,000 of the old company are afloat, it required the increase of stock on the part of the new company to secure the conversion. This increase is divided into 100,000 shares at $25 each. None of it will be sold, but will be absorbed for the purpose mentioned, and the stockholders of the old company will be the same in the new company. The Mutual Union Telegraph Company will cease to exist as soon as the transfer of stock is completed, but from its ashes will rise the New York Mutual Telegraph Company. By the terms of lease with the Western Union the new stock is guaranteed at 6 per cent. income.

Electricity and Compressed Air as Transmitters of Power.

Some competitive experiments were made lately at the mines of Blanzy, in France, between electricity and compressed air as means of operating a ventilator eighty centimetres diameter and thirty centimetres wide. For compressed air a ten-horse power engine was used with a Soutter and Lemonnier air compressor. The cost of material and the expense of the mason work, laying the pipes, conduits, etc., amounted to 14,770 francs. In the case of electricity the expense of installation, including a ten-horse engine, two Gramme machine, one as generator, the other as motor, cables, etc., amounted to only 4,244 francs; in other words, the cost of plant was three times greater for compressed air than for electricity. The cost of running also showed a difference nearly as great in favor of electricity.

IT is now proposed to use the enormous water-power of the Alps for working electric railways in Switzerland. Operations are understood to be in progress now to connect the towns of St. Moritz and Pontresina by an electric railway 4¾ miles long, the motive power to be supplied by the mountain streams. Should the experiment succeed, the undertakers of the railway will extend it to the north for a distance of some 47 miles, and in a southerly direction for about 30 miles, and thus effect a second junction between the Swiss and Italian railways.

The First Telephone.

Within the last year considerable interest has been manifested in the first experiments made in telephony—those of Prof. Philip Reis, of Germany, which scientists have been analyzing for the purpose of estimating their merit at a just value. Prof. Silvanus P. Thompson, in England, has devoted himself diligently to the subject, and from preceding communications on the Reis telephone which he has made to the electrical press, it seems evident that he must possess good facilities for securing information about it, and his views may be deemed quite authoritative. Knowing that many readers of THE ELECTRICAL WORLD are interested in the early history of the telephone, we reproduce below a paper read by Professor Thompson before the Bristol Naturalists' Society on "The First Telephone," which forms an important contribution to this history:

On the 12th of May, 1862, says Professor Thompson, there met together in a fine old hall in the city of Frankfort-on-the Main a crowded audience, eager to see and hear the latest scientific invention expounded by its inventor. The occasion was the meeting of the Free German Institute (Freies Deutsches Hochstift), a sort of literary and philosophical society, which has since domiciled itself in the historical old house where Goethe was born. The invention which attracted so notable a crowd was the telephone. The inventor was Philip Reis, a teacher of natural sciences in Garnier's Institute, a flourishing boys' school at Fredrichsdorf, near Homburg.

On one occasion previously had the telephone been publicly exhibited, namely, at a meeting of the Physical Society of Frankfort, on the 22d of October in the preceding year.

In the journal of the Frankfort Society (*Jahresbericht des Physikalischen Vereins zu Frankfurt am Main*) for 1860-61, p. 57, may be found the memoir of Philip Reis on the subject, under the title "On Telephony by the Galvanic Current." In this memoir, which shows a marvelous precision and a grasp of the subject that excites admiration and wonder, the author says: "I have now succeeded in constructing an apparatus by means of which I am in a position to reproduce the tones of divers instruments, and even to a certain degree the human voice." The inventor further says: "Since the length of the conducting wire may be extended for this purpose just as far as in direct telegraphy, I give to my instrument the name 'Telephone.'" Toward the end of the memoir it is stated that until now it has not been possible to reproduce the tones of human speech with a distinctness sufficient to satisfy everybody; adding: "The consonants are for the most part tolerably distinctly produced, but the vowels not yet to an equal degree." The author of the memoir in which these statements occur had been led to his invention by a remarkably suggestive line of thought. He had wanted an instrument to transmit electrically everything and anything that a human ear could hear. Accordingly he took the human ear itself as a model. "How," he argues, "could a single instrument reproduce at once the total actions of all the organs operated in human speech? This was ever the cardinal question. At last I came by accident to put this question another way: How does *our ear* perceive the total (or resultant) vibrations of all the simultaneously-operant organs of speech?" He then goes on to describe the action of the auditory ossicles when the ear is made the recipient of sound, pointing out how they execute movements and exert forces upon one another in proportion to the condensations occurring in the sound-conducting medium and to the amplitudes of vibration of the tympanum.

Having stated this law of proportion between the cause and its effect, he goes on to speak of the graphic method of representing varying forces, such as those of sound-waves, by curves; and emphatically lays down that the ear is absolutely incapable of presenting anything more than can be expressed by such a curve. After giving samples of undulatory curves corresponding to musical and discordant sounds, he makes the following significant remark:

"So soon, therefore, as it is possible at any place and in any manner to set up vibrations whose curves are like those of any given tone or combination of tones, we shall then receive the same impression which the tone or combination of tones would have produced upon us. Taking my stand upon the preceding principles, I have succeeded in constructing an apparatus", etc. He concludes his paper by saying that the newly-invented phonautograph of Duhamel may perhaps afford evidence as to the correctness of the views which he has asserted respecting the correspondence between sounds and their curves.

The actual apparatus figured in this memoir, and exhibited to the Frankfort Society in October, 1861, is now in my possession; and I have also temporarily intrusted to me a still earlier experimental telephone, made by Philip Reis, in the form of a model of the human ear.* This interesting instrument is depicted in its natural condition and size in Figs. 1, 2 and 3, and in section in Fig. 4.

It is carved in oak wood. Of the tympanic membrane only small fragments now exist. Against the centre of the tympanum rested the lower end of a little curved lever of platinum wire, which represented the "hammer" bone of the human ear. This curved lever was attached to the membrane by a minute drop of sealing wax, so that it moved in correspondence with every movement of the tympanum. It was pivoted near its centre by being soldered to a short cross wire serving as an axis. The upper end of the curved lever rested in loose contact against the upper end of a vertical spring about one inch long, bearing at its summit a slender and resilient strip of platinum foil (see Fig. 4). An adjusting screw served to regulate the degree of contact between the vertical spring and the curved lever. Conducting wires, by means of which the current of electricity entered and left the apparatus, were affixed to screws in connection respectively with the support of the pivoted lever and with the vertical spring. A springy strip of platinum pressed against the end of the pivot of the lever (as shown enlarged in Fig. 5) to insure good electrical contact.

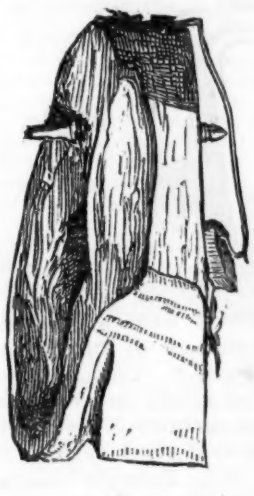

FIG. 1.

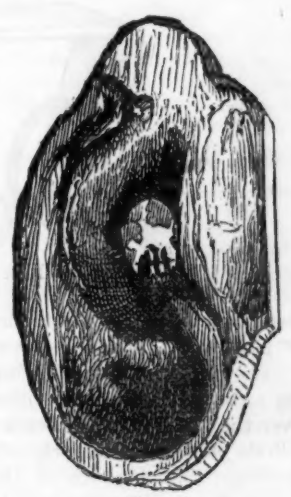

FIG. 2.

If now any words or sounds of any kind were uttered in front of the "ear," the membrane was thereby set into vibrations as in the human ear. The little curved lever took up these motions precisely as does the "hammer" bone of the human ear; and, like the "hammer"bone, transferred them to that with which it was in contact. The result was that the contact between the upper end of the lever and the spring was caused to vary. With every rarefaction of the air the membrane moved forward and the upper end of the little lever moved backward and pressed more firmly than before against the spring, making better contact and allowing a stronger current to flow. At every condensation of the air the membrane moved backward and the upper end of the lever moved forward so as to press less strongly than before against the spring, thereby making a less complete contact than before: and by thus partially interrupting the passage of the current, caused the current to flow less freely. The sound-waves which entered the air would in this fashion throw the electric current, which flowed through the point of variable contact, into undulations in strength.

Reis himself termed the contact-part of his telephone an "interrupter." That it was not intended to operate as an abrupt make-and-break arrangement, as some persons have erroneously fancied, is evident; firstly, because the inventor introduced delicate springs to give a following contact (like that in Blake's well-known "transmitter"),

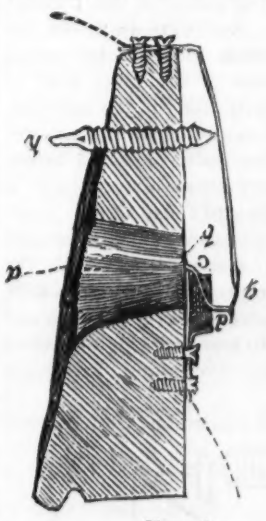

FIG. 3.

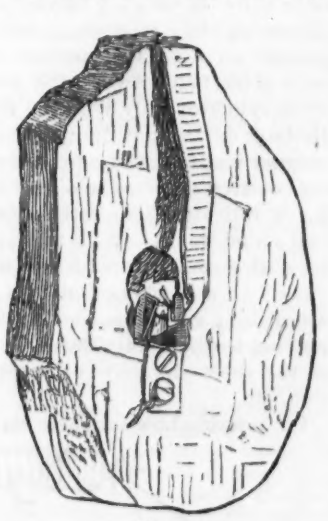

FIG. 4.

and so prevent abrupt breaks from occurring; secondly, because abrupt breaks would have violated the fundamental principle to which he refers in the sentence immediately preceding his description of the instrument shown to the Frankfort Society, namely, that of creating tones whoses curves were like the undulatory curves imparted at the transmitting end of the instrument; thirdly, because (in another article) he described his instruments as opening and closing the circuit in proportion to the sound-wave; which obviously an abrupt "break-and-make" apparatus without a spring contact could not possibly do. The mechanism which Reis thus invented, and which is substantially alike in all his instruments, might be appropriately described as the combination of a tympanum with an electric current-regulator; the essential principal of the electric current-regulator being the employment of a

* The property of Leon Garnier, Esq., Director of Garnier's Institute, at Friendrichsdorf, near Homburg, where Philip Reis was formerly Teacher of Natural Science.

loose or imperfect contact between the two parts of the conducting system, these parts being so arranged that the vibrations of the tympanum would alter the degree of contact, or occasion an approach and recession of the atoms of the two surfaces, and so vary the resistance offered at the point of contact to the flow of the current.

The particular form of the iustrument shown at Frankfort in 1861, and described in the *Journal*, is somewhat different from the "ear." The description is taken from the *Journal*. "In a cube of wood there is a conical hole closed at one side by the membrane (made of the lesser in-

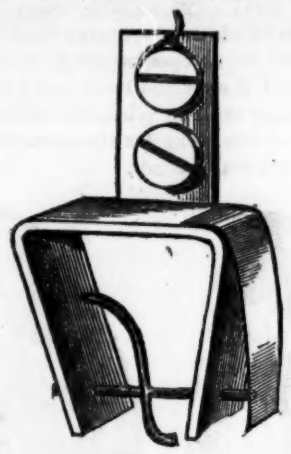

FIG. 5.

testine of the pig), upon the middle of which a little strip of platinum is cemented as a conductor of the current. This is united with the binding-screw *P*. From the binding-screw *n* there passes likewise a thin strip of metal over the middle of the membrane, and terminates here in a little platinum wire, which stands at right angles with the length and breadth of the strip. From the binding-screw *P* a conducting wire leads through the battery to a distant station." In the original instrument there is also an adjusting-screw to regulate the contact, though this was not shown in the drawing in the Frankfort *Journal*.

The receiver used to reproduce the sounds transmitted by these telephones is also described in the memoir of Reis. It consisted of a steel needle surrounded by a coil of wire. This was at first set up—for the purpose of increasing the sounds by resonance—upon the top of a violin, as shown in Fig. 6; later it was mounted upon a pine wood box, as in Fig. 7, to which still later a lid of thin pine

FIG. 6.

was added, against which the listener could press his ear. The sounds emitted by such a wire during magnetization and demagnetization were well known before, but to Reis is due the discovery that other tones than the natural vibration tone of the wire could be electrically imposed upon it by the varying magnetizing power of the current traversing the surrounding coil. Reis explained the reproduction of the transmitted sounds by supposing a magnetic attraction between the atoms of the steel wire to work synchronously with the fluctuation of the current. He later devised a different receiver, in which an electro-magnet was provided with an elastically-mounted armature of iron attached to a light and broad lever, which it threw into vibrations corresponding to those of the original sound-waves. With this apparatus, and a transmitter with a small curved lever, in shape like that in the "ear," he was able not only to reproduce melodies with astonishing exactness, and single words as in speaking and reading less distinctly, but even to transmit the inflections of the voice expressive of surprise, command, interrogation, etc.

Considering how far these early researches were carried,

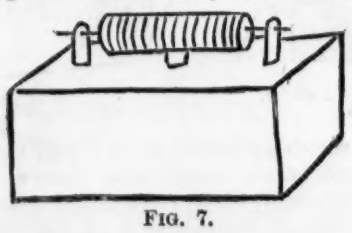

FIG. 7.

it is remarkable that their historic value has been so greatly overlooked. The transmitters which Reis devised embody—though their mechanical design is less perfect, and their performance consequently less certain—all the essential principles of the telephonic transmitters in use to-day, such as Blake's, Berliner's, Crossley's. The receivers devised by Reis, more particularly the second form, anticipate every principal essential in the more modern and convenient receiver of Graham Bell, having an electro-magnet combined with an armature capable of inductive action—*i. e.*, made of iron, elastically mounted, and having an extended surface. Bell made the very great improvement of uniting these three qualities essential to the armature in one by employing as armature a thin flexible iron plate. It is but just to the later inventors to add that both Bell and Edison have explicitly referred to Reis's prior work, Bell even going so far as to name the pages of Kuhn's Handbook from which the preceding reference is taken.

Winding and Setting Clocks by Electricity.

Speaking of the electric wonders of the day the New Haven (Conn.) *Register* says:

It seems certain that many other analogous uses of the electric current are to be perfected for the convenience of the public, one of which is the transmission of time signals by which clocks are to be kept to standard time from a controlling clock in place of the present system, in which each clock is independent and no two indicating the same time.

As early as 1841 and 1847 the attempt was made to operate a number of clocks from one standard clock over an electric circuit, and new forms of electric clocks have multiplied since then, but no marked improvement, no perfected system, has been developed until now. Those that were heretofore attempted required wires to be constructed especially for working the clocks, and the cost of construction and maintenance of these systems, with the uncertainty of their operation, defeated their introduction.

Charles E. Buell, of this city, has overcome the difficulties that attended former efforts in this direction, and has patented a system by which cheaply constructed clocks are kept in motion by a local battery, consisting of metal plates buried in the earth, or a secondary battery at each clock kept charged by the waste currents flowing over a line wire used for a district, or message telegraph, or telephone circuit. These clocks, so wound or actuated, are adjusted to a fair degree of accuracy by the ordinary mode of adjusting clocks, and are then set to correct time every twelve hours by an impulse sent over the telegraph or signal wire from a standard clock, thus giving correct and uniform time at each one, avoiding the expense and uncertainties of previous clock systems, and admitting of the profuse distribution of clocks that are cheap and require no attention or winding, and can be controlled over the longest circuits as readily as over shorter ones. Such a time system must meet with public favor in the nineteenth century, when the civilized world is being run on schedule time, and absolutely correct and uniform time is a necessity.

The Wachusetts Electric Light Company's Fitchburg Station.

The Wachusetts Electric Light Company's new station on Water street, at Fitchburg, Mass., was formally opened on the evening of the 27th ult. Many persons were present.

The building, which was intended for a boiler house and engine room for the Fitchburg Lumber Company, is solid and substantial. The engine rests on a sold granite foundation, and the timbers underneath the dynamo-electric machines are supported by walls of solid masonry. The engine runs nearly as steadily as a chronometer, and the machinery causes the least perceptible tremor.

The engine room is 16x31½ feet. The engine, of 75 horse-power, was built by the Fitchburg Steam Engine Company, and the foundation is laid for another engine of 100 horse-power, which will be connected with the fly-wheel shaft. The dynamo room is 13x31½ feet, and has capacity for machines producing 250 lights. Five dynamos are in operation, and two more, each with capacity to run 28 lights, will be added in a few days.

The boiler room, 10x31, contains a boiler of 80 horse-power, and the foundation is laid for another boiler of 100 horse-power. The company has a contract with Fitchburg for lighting Main street and parts of Lunenburg, Summer and Water streets. It has an independent line. At present there are three circuits, and two more will be added.

Pneumatic Tubes for Postal Business.

The *Mail and Express* of this city says: "The scheme to establish a pneumatic tube four inches in diameter between New York and Chicago challenges public interest. Small pneumatic tubes to convey messages for short distances have become almost indispensable in certain places, and great advantage is expected to result from the establishment of connection by pneumatic tubes between the Western Union building and the branch telegraph office in Twenty-third street. Large tubes have also been used in London and Paris with satisfactory results for several years, the tube two and a half feet in diameter which was laid in the former city in 1861 having conveyed a carriage weighing 700 pounds at the rate of thirty miles an hour. But the tube was only a quarter of a mile long. It is uncertain whether the pneumatic system can be profitably worked at so great a distance as that from New York to Chicago, but the experiment is likely to be tried, it is said. As pneumatic tubes four feet and a half in diameter and several miles long are now in use in London, it may be worth while to repeat a suggestion made by us two or three years ago, that pneumatic tubes be used to convey letters between the postal stations in New York City. The time of delivery would be greatly reduced were the suggestion adopted."

On Winding Electro-Magnets.

BY PROFS. W. E. AYRTON, F.R. S., AND JOHN PERRY, M. E. *

The following experiments were made to determine which mode of winding a given length of wire on an iron bar gave the strongest electro-magnet for the same current. Four bars of iron, each 12 inches long, were cut from the same rod ⅝ inch thick; and an exactly equal length of wire was wound on the four bars respectively, in the following way:

1. Wire wound equally over the whole length (Fig. 1).
2. Wire coned toward each end (Fig. 2).
3. Wire wound equally over half the iron bar, leaving the other end bare (Fig. 3).
4. Wire wound on one-half, but coned toward the end (Fig. 4).

Electro-magnet No. 1 was put so that its axis was at right angles to the axis of a small magnetic needle and passed through the point of suspension of the needle,

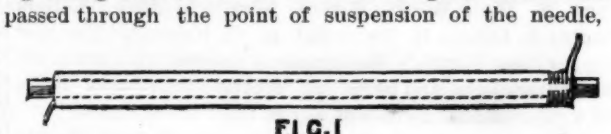

FIG. 1

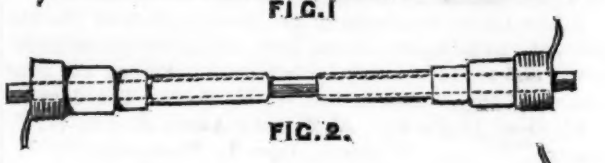

FIG. 2.

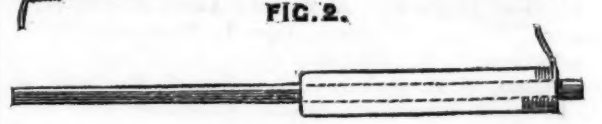

FIG. 3

FIG. 4.

which was suspended so as to move freely in a horizontal plane, and far enough away that the magnetic field due to the electro-magnet No. 1, when magnetized by passing a current through it, was nearly constant over that portion of the field in which the little suspended needle moved when deflected. A constant current was now passed through the coil on No. 1, and the deflection of the little needle observed when No. 1 was placed at different distances from the centre of the test-needle, the axis of No. 1, however, always remaining in the same line. Under these circumstances it is well known that the strength of the field produced by No. 1 at the centre of the test-needle is approximately proportional to the tangent of its deflection. Experiments were now made in a similar way with electro-magnet No. 2, and with each end of No. 3 and of No. 4, the same current as was employed with electro-magnet No. 1 being used in all cases, and which was much below the saturating current.

The results obtained are given in the accompanying table, and are shown plotted in the accompanying curves (Fig. 9), vertical distances representing the distance between the near end of the electro-magnet and the centre of the test-needle, and horizontal distances the tangents of the deflection of the test-needle: *aaaa* is that for No. 1; *bbbb* for

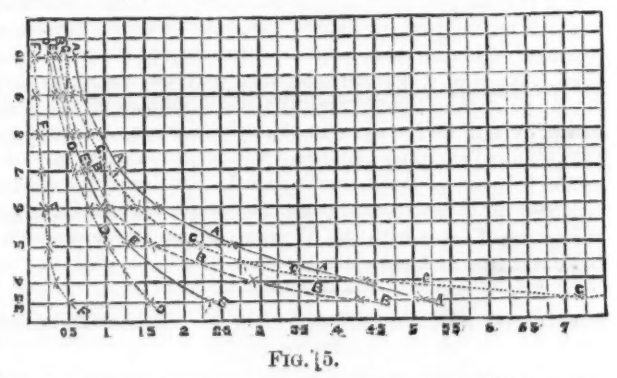

FIG. 5.

No. 2; *cccc* for the covered end of No. 3; *dddd* for the uncovered end of No. 3; *eeee* for the covered end of No. 4; and *ffff* for the uncovered end of No. 4.

Distance in inches between the near end of the bar and the centre of the test-needle.	No. 1.		No. 2.		No. 3.				No. 4.			
					Covered end.		Bare end.		Covered end.		Bare end.	
	Def..	Tan..	Def..	Tan..	Def..	Tan..	Def..	Tan..	Def..	Tan..	Def..	Tan..
3½.....	79°	5.14	77°	4 33	82°	7.12	57°	1.54	67°	2.30	27°	0.57
4	77	4.33	71	2.9	77	4.33	53	1.33	62	1.88	21	0.38
5	69½	2.67	58	1.6	66	2.24	46	1.04	52	1.28	14	0.28
6	59	1.66	47	1.07	56	1.48	39	0.81	43	0.93	11	0.19
7	50	1.19	37	0.76	46	1.04	32	0.62	36	0.73	9	0.16
8	42	0.9	30	0.58	37½	0.79	27½	0.52	29	0.56	7	0.12
9	35	0.7	24	0.46	30	0.58	18	0.32	22	0.48	4	0.07
10	30	0.58	20	0.36	25	0.47	13	0.23	17	0.3	3	0.05

To ascertain the distribution of the lines of force, iron filings were sprinkled on paraffined paper, and the positions the filings took up fixed by the paraffine being softened by a heated piece of copper being passed over the paper at a short distance above it. From the curves in Fig. 5 and from the iron-filing curves it was seen that the

* *London Philosophical Magazine*, June, 1883.)

effect of coning the wire was to produce a strong field very near the pole, but that the force falls off very rapidly as the distance from the pole increases. With No. 2 magnet, for instance, the field between the poles is so weak that scarcely any definite arrangement of filings is traceable in the diagram corresponding with it.

From the curves in Fig. 5 it is seen that, at considerable distances from the end of the electro-magnet, the uniformly coiled magnet No. 1 produces the most powerful field, while for points nearer the magnet, but still at a distance of about 3 inches from it, the covered end of No. 3 magnet, corresponding with the curve *c c c* produces the strongest field, the next strongest being produced by the magnet No. 2 with the wire coned toward each end, since obviously the curve *b b b* cuts the curve *a a a* at a point corresponding with a distance of about 3 inches from the end of the magnet. For distances very close to the magnet this method of experimenting cannot, of course, be employed to measure the resultant force accurately; and hence observations by this method at distances of less than 3½ inches from the end of the magnet to the centre of the oscillating needle were not made, and conclusions as to the resultant magnetic force very close to the poles must, of course, not be drawn from the curves in Fig. 4.

Returning to the curves taken up by the iron filings. No. 1 magnet gives an arrangement similar to that of an ordinary regularly magnetized bar-magnet. With No. 2 the lines around the poles are similar to those of No. 1, but the field between the poles is very weak. Magnets No. 3 and 4 give very similar figures, showing a very peculiar distribution of force. There is a great concentration of the lines at the pole corresponding to half of the iron which is covered with wire; but the unwound end seems to form a long, weak pole, with its maximum force near the centre of the bar, *i. e.*, at the inner end of the coil—the differences between these two being, that with No. 4 magnet there is, comparatively, a greater concentration of force at the wound pole, and that the opposite pole is longer and extends a little way into the coil—the result of the coning of the wire. In these two cases the unwound end of the iron seems to act like an armature.

To ascertain the force which each magnet would exert on an armature, experiments were made and the following results obtained, the current flowing through the coil in each case being exactly the same, as well as the armature employed:

Magnet.	Weight required to detach the armature from the covered end of the magnet.
No. 1	45 ounces.
2	57 "
3	57 "
4	77 "

These results confirm those previously obtained, that the field produced by the covered ends of the electro-magnets numbers 2 or 3 at distances near the pole is much stronger than that produced by No. 1. But they show something else, viz., that for very small distances it is the covered end of No. 4 that produces the strongest field. In other words, returning to Fig. 5, the curve, *e e*, although much below the curves *a a*, *b b* and *c c*, must rise rapidly and cut the others just as the curve *c c* cuts the curve *a a* at a point corresponding with a distance of about 4.2 inches from the end of the magnet, and just as, again, the curve *b b* cuts *a a* at a point corresponding with a distance of about 3.2 inches from the end of the magnet. The curves of iron filings indeed give indication of the great strength and concentration of field there is produced close to the iron by the wire coned at the end, as employed in the magnet No. 4.

With, then, a definite iron core, a definite length of wire to be coiled on it, and to be traversed with a definite current, the mode of coiling to produce the largest field depends entirely on the distance from the end of the electro-magnet at which the field is to be produced. With the particular magnet we have employed we see that, at very short distances from the end of the magnet compared with the length of the core, the wire should all be coiled up at the near end of the core, as in Fig. 4; to create a field at a distance from the end of the magnet equal to about a third of the length of the magnet, it is better to coil the wire uniformly over one-half of the core, as in Fig. 2, than to cone it up at the near end, as in Fig. 4; while, for distances from the end of the magnet equal to or greater than about ⅔ of the length of the core, the uniform mode of winding is the best.

We have to thank two of our students, Messrs. Sayers and Pink, for most cordial assistance rendered us in this investigation.

The Telephone in the Northwest.

The work of putting up fifty wire cables has begun in Minneapolis, Minn. They are to branch out from the City Hall in various directions, taking the place of the single wires now in use. Mr. E. E. Downes, brother of Mr. L. N. Downes, manager of the entire system, is in charge of construction.

These cables, containing fifty wires each, will do away with the network of wires which now fill the air. There are also many other improvements being made in the system looking to its early perfection, so that it shall stand second to none in the country. A new switch-board, called the multiple, is being put into the central office, by which the old system of switching, which often consumes several minutes, will be done away with. This is the third board of the style yet manufactured. The first was put into the exchange at Indianapolis, the second at Kansas City. By its use every operator can reach instantly and make any desired connection, whereas by the old style oftentimes the connection required the filling out of an order and sending it by a boy from one end of the room to the other.

Minneapolis and St. Paul are being connected by ten No. 10 wires, which are four times the size of those now in use. The labor in getting these wires up and into operation will be completed within two weeks.

In the thickly settled portion of the city new poles with fourteen foot cross bars are being erected so that more space may be between the wires, avoiding the possibility of crossing wires.

Mr. Temple, the superintendent, is now in Yankton, negotiating for the purchase of the exchange there, which will complete the entire Northwestern circuit, including all of Minnesota, Dakota and a goodly portion of Wisconsin.

Supt. Henion, of the water commissioners, is in correspondence with the Bell Company of Cincinnati, looking to an experiment with the Bell waterphone, which is an instrument for the purpose of testing all mains and pipes for the detection of leaks or waste of water. The water commissioners are convinced that the daily waste of water in Minneapolis is great, and are anxious to detect the parties guilty of making it.

The Mechanical Part of Electrical Construction.

Some mechanical engineers who have recently been investigating the operations of the electric-light companies with a view to the introduction of electric-light plants, have made most unfavorable criticisms upon the mechanical construction of some of the electric-light machinery at present turned out. Their complaint is that it is rough, carelessly made and poorly fitted, and that before a high efficiency can be attained by certain companies their methods of construction must be entirely remodeled, and the work done on the dynamos be as fine and as accurate, to say the least, as that to be found on engines which are to run at a similar rate of speed. Whether this criticism is just or not we cannot say from personal inspection of the machines in question, but we are inclined to think it has a fair foundation. On the other hand, we have heard high praise awarded to certain manufacturers for the care which they take in the construction of all parts of their dynamos.—*Iron Age.*

THE TELEGRAPH.

UNDERGROUND WIRES IN FRANCE.—There are now more than 700 miles of underground telegraph lines in France, and 1,300 miles more are being laid.

REPAIRING THE CABLES.—The telegraph cables in the Gulf of St. Lawrence are being repaired, and new ones will be laid along the north shore of the river and gulf through the Straits of Belle Isle to the northern points of Labrador.

LIGHTNING IN AN OFFICE.—Lightning struck a pine-tree in Centre Harbor, N. H., a few days ago, about one-half mile from the telegraph office, and followed the wire into it. Mr. Farrell, the operator, was badly stunned, and others in the store were affected.

A CYCLONE.—An Associated Press telegraph operator out West got married the other day, and a week after forgot to take home a new bonnet he had promised his wife. Next morning the country was startled by a dispatch announcing a "terrible cyclone which crossed over the State, desolating the country for miles around."

JAPAN ASSISTS A TELEGRAPH COMPANY.—The Japanese Empire is in favor of electric improvements, if its crops have failed. A tornado destroyed many of its poppy plants, and the tea trade languishes, yet the government will allow the Great Northern Telegraph Company $62,000 to defray the expenses of laying a cable from Nagasaki to Corea.

TELEGRAPH EXTENSION IN WISCONSIN.—An Ashland, Wis., special says: "The new telegraph line along the Milwaukee, St. Paul, Minneapolis & Omaha line is completed to this city, and now the citizens of this place have direct communication with Hudson, St. Paul and westward. The line will be operated at the Wisconsin Central depot for the present."

A CELESTIAL TELEGRAPH.—A telegraph line has lately been established between Shanghai and Tientsin. It is now to be extended to Pekin, as the prejudice has been removed. Telegrams are to be forwarded either in French or in English. Yet there is a strict scrutiny to be kept by two mandarins. The duty of these officials will be to see to it that no messages will pass over the wires by which the State would be endangered.

THE MATTER WITH WESTERN UNION.—It is a difficult task to lift Western Union stock to a figure which will make it a tempting investment. Were it really the 7 per cent. security the current dividends would represent it to be, the stock should be selling a number of points above par, instead of at 86. Western Union is clearly suffering from too much water, too much competition (and more prospectively than at present) and too much Jay Gould. —*Boston Herald.*

ORANGE JUDD'S TELEGRAPH LINE.—The report that Mr. Orange Judd, the well-known agricultural editor and publisher, and benefactor of Wesleyan University, was dying in Florida, arose from a misunderstanding of a telegram which referred to the father of Mr. Judd's wife, who died last week. Mr. Judd is now about sixty-one years old. It is said that when he was a student at Middletown he erected the first telegraph line in Connecticut, leading from his room out and around the college building and back to his room again.

A CONVENTION OF MANAGERS.—A Dallas, Texas, dispatch of June 22 says: "The managers of the telegraph offices of the principal towns in Texas held a meeting in this city, Mr. G. M. Baker, of Dallas, president, and Mr. E. J. Smith, of Fort Worth, was secretary. The object of the meeting was to discuss the question of improving the telegraphic facilities. Business is increasing so rapidly in Texas as to require better facilities than the managers now have. The matter was pretty thoroughly canvassed by the meeting, but no definite action taken."

THE GREATEST WIRE IN THE WORLD.—George Alfred Townsend writes: "I observe that the Postal Telegraph Company has obtained a strong board of directors. The President of the Erie Railroad, the President of the Delaware & Hudson Canal Company, the President of the Fort Wayne Railroad, and men of equal character have come forward and put their hands in it. Such a wire is not possessed in this world outside of the ocean cables; it is a powerful cylinder of copper with a steel centre. George D. Roberts, who is a venturesome man, got most of the money to produce this wire, which now reaches to Chicago, and aims speedy extension to the great terminal and business points of the continent."

ANOTHER TELEGRAPH WAR.—A circular was passed around among the Chicago offices on Friday of last week, announcing a war of rates by the Mutual Union Telegraph Company. The circular states that for fifteen cents ten words will be sent by night message between Chicago, New York, Philadelphia, St. Louis, Baltimore, Louisville, Washington, Cincinnati, Pittsburgh and Columbus. The movement is understood to be a preliminary anticipation of a possible pool again the Western Union, comprising the Postal Telegraph Company, the Baltimore & Ohio, Southern, American Rapid and Board of Trade companies. Superintendent Sholes of the Mutual Union says that the company has cut rates to meet a similar reduction by the Baltimore & Ohio Company.

STILLMAN WITT.—The Broadway Lounger of the *Tribune* of this city says: Mr. Schenck, who keeps the Westminster Hotel, yesterday said to me: "Do you remember when I asked you to go to Judge Hilton and see if I could not get the lease of Stewart's down-town store? I could have made a nice fortune for myself and first-rate rent for that estate in the intervening years before the property was altered. When I took this hotel everybody thought there was no money in it. I have put up an apartment house next door at a cost of $190,000. The property belongs to the Stillman Witt estate of Cleveland." Mr. Schenck did not seem to know who Stillman Witt was. He was the chief telegraph builder through the Western States and one of the chief consolidators of what is now the Western Union Telegraph Company.

DECISION AGAINST THE WESTERN UNION.—On July 2 Judge Freedman, in this city, denied the motions made by the Western Union Telegraph Company for the dissolution of the Williams and Hatch injunctions. The company proposed to give bonds to secure Messrs. Williams and Hatch against any loss through the doings of the things restrained by the injunctions, namely, the paying of dividends on the $15,526,590 of its stock which was issued as a stock dividend at the time of the American Union consolidation. Judge Freedman says that the General Term having declared this stock illegally issued, "no court has any right or power upon an offer by a corporation to indemnify a few individuals against pecuniary loss, to grant, in effect, permission to such corporation to violate the law of the land. The motion must be denied, with $10 costs."

THE TELEGRAPH IN JOURNALISM.—In an address on "Journalism," delivered by Mr. Charles Emory Smith, at Lafayette College a few days ago, the speaker referred to the part played by the telegraph in the development of modern journalism, and said: "A number of journals now have their own special wires from leading points. The time will soon come when apart from their ordinary newsgatherers, they will keep the ablest men they can find constantly at the capitals to deal critically with the operations and the legislation of the hour; when the editorial comments will be written on the scene, with all the color and life and intelligence of actual presence; when they will be put upon the wires as freely as the general news—nay, further, the time is near at hand when the keenest and most experienced observer, waiting till the last moment for the freshest phases in the kaleideoscopic changes, will stand at the telephone in Washington and talk his clear, well-digested comment; when it will be simultaneously received in the newspaper office in Philadelphia, instantly converted by the type-writer into printed copy, and immediately passed on to the composing-room; in short, when the carefully gathered information of the acutest journalist spoken in Washington at 1 o'clock in the morning over the wire will be all ready at 2 o'clock in Philadelphia to be rattled off the printing press at the rate of fifty thousand an hour."

THE AMERICAN, BRITISH AND CONTINENTAL CABLE COMPANY.—The capital stock of the new cable company briefly referred to in last issue is £1,500,000, all of which has been subscribed by English capitalists. It is proposed to lay two cables. One will extend from a point near Glasgow, Scotland, to Belle Isle, 300 miles north of Heart's Content, Newfoundland. This line is intended largely for Canadian business, and has some indirect connection with the Canadian Pacific scheme. The other will extend from Land's End to Sable Island, 200 miles southeast of Halifax, N. S. Thence a cable will be laid to a point on the eastern end of Long Island, where a terminus has already been secured. The cable is being manufactured by the Henley Telegraph Works Company, and the contract stipulates that it must be completed this year. The new cable company will connect with the lines of the Postal Telegraph Company on this side, and the agreement with the company provides that no pooling of earnings or combination with other cable companies shall take place. Alderman Hadley, of London, who has been in Boston during the past week in the interest of the above cable company, has become interested in the workings of the district messenger system, and on his return to London he will endeavor to introduce the system in London as an adjunct and supplement to his cable and telegraph service. It is understood that the cable company and the Postal Telegraph Company, which is to be its American connection, have signed a rigid contract, with heavy penalties, not to sell, lease, or co-operate with the Western Union or the present cable companies. It is understood that the Postal people are now getting out their material for running a large six-wire copper line from New York to Bangor, Me., via Boston, with offices in the cities and towns along the

route. Telegraph men in Boston think this combination promises to be a stronger competition to the Western Union than even the late lamented Mutual Union.

THE TELEPHONE.

TELEPHONE OUTPUT.—The net output of telephones by the Bell Company for the month ending June 20 was 7,038.

INDIVIDUAL BELLS.—An exchange says that the Currier Telephone Bell Company of Lowell has received an order from the Bell Company of Philadelphia for 500 individual bells.

A CHANGE.—Miss Minnie Kellogg, of Amherst, succeeds Miss Fanny Hurd as day operator at the telephone at Northampton, Mass.

INCORPORATED.—A certificate of incorporation has been issued at Wilmington, Del., to the Penn Overland Telephone and Telegraph Company.

EXTENSIONS.—A telephone line has been erected between Bushnell and Peoria, Ill., and the same line will soon connect Macomb and Monmouth. Russellville and Dardanelle, Ark., have been connected by telephone.

THE BANNER TOWN TELEPHONICALLY.—Petersburg, Ill., population 2,332, has a telephone exchange of seventy-two subscribers on seventy-two circuits. Over three and eight-tenths per cent. of the inhabitants have telephones, and five toll lines run to neighboring towns and cities. It is Petersburg's boast that no place in the United States can excel it in telephonic progress in proportion to population.

SOUTH AMERICAN COMPANIES.—The Tropical Telephone Company is sending 500 sets of instruments to the United Telephone Company of the Argentine Republic, making 1,700 sets sent to South America. The United Company of the River Platte has a large and constantly growing business. The April receipts of the company were $5,000 in gold. There were added in April 101 subscribers, making 917 on the books of the company.

A NEW TELEPHONE COMPANY.—The certificate of incorporation of the Chesapeake and Potomac Telephone Company was filed on the 30th ult. in the County Clerk's office. The capital stock of the company is fixed at $50,000, divided into 500 shares. The intention is to run wires from this city to the Potomac River, connecting with wires throughout the country. The incorporators are H. P. Frost, H. B. Little, M. F. Tyler, H. D. Cooke and H. G. Davis.

THE SOUTHWESTERN TELEPHONE COMPANY.—It appears from an interview with Manager L. N. Downs, of the Southwestern Telephone Company, operating in Texas, that 150 subscribers are ready for connection on the Mexican side as soon as cables are laid at Brownsville and El Paso. The question is raised whether an extension of the Southwestern's lines into Mexican territory will not be an invasion of the privileges of the Mexican Telephone Company.

TELEPHONY IN TEXAS.—The telephone exchange in Dallas, Texas, is still increasing its business. Lines now extend to nine different towns, and more are building to Ennis, Alvarado, Clebourne, Garret, Italy, Milford, Midlothian and others. The subscribers number about two hundred and eighty-five. Mr. D. M. Clowes, manager, has been promoted to the office of division superintendent, his territory being all that north of the thirty-first parallel and west of longitude 96.

THE OSHKOSH TROUBLE.—The conflict between the Oshkosh city authorities and the telephone company, referred to last issue, was brought to a climax June 2 by Mayor Pratt, who ordered the Chief of Police and the head of the Fire Department to cut down the company's poles. One pole was chopped down and the wires were cut and removed from two or three other poles, in the presence of a large crowd. The telephone men then climbed the poles along the line and prevented any more chopping. Litigation is expected.

RENT FOR TIME TELEPHONES ARE OUT OF ORDER.—The Metropolitan Telephone Company of this city brought a suit against Russell & Banks, bookbinders, to recover three months' rent (January, February and March, 1881) for the use of a telephone, which was tried in the First District Court on the 30th ult. It will be remembered by electricians that on January 21, 1881, a severe sleet-storm occurred, which broke down the company's wires. On account of this, the defendants were unable to use their telephone. They claim to have frequently notified the company of their inability to work the telephone, and asked that it be repaired. The company claimed that it was not bound to keep the wires in repair. Justice Norton ordered a verdict for the plaintiff for $5, being the amount of rent due at the time of the storm. He did not think the plaintiff entitled to what accrued afterward, on account of the failure to keep the telephone and wires in repair.

THE MEXICAN TELEPHONE COMPANY.—The $50,000 needed by this company to carry out its programme appears likely to be raised by the issue of 25,000 shares of new stock, which the larger present holders in Boston are willing to take at $2, on condition that the executive management and headquarters of the company be removed from New York to Boston. Most of the stock is held in Boston and New England, and the request is therefore considered a reasonable one. It is understood that President Delano and Treasurer Haines are ready to turn over the insignia of office on payment of their claim of $16,000 against the company. A prominent Boston director is mentioned for president, and Mr. William Reed, a well-known broker and treasurer of the South Boston Railroad Company, for treasurer and manager. Both names are favorably received, and both gentlemen will probably accept the offices when vacant. Mr. Reed is ready to subscribe liberally to the new stock. It will require time to carry out the changes, a meeting of the stockholders being a necessity to that end.

INTERESTING TIME-SIGNALING INVENTIONS.—A correspondent at Dallas, Texas, writes: The telephone exchange here has been greatly benefited by the time-signaling inventions of Mr. J. M. Cram. The first was his noon signal, an apparatus which automatically rings every bell in the city at precisely noon daily. The next is the grandest time invention of the age. It is a small machine about eight inches square by two and one-half in height, and when attached to a certain branch wire from the switch-board, converts every telephone in the city into a chronometer, giving the exact time every minute in the day to within less than the fractional part of a second. Any subscriber can hear the exact time any minute by simply placing the hand phone to the ear. It is not necessary to ring the office; the time is always on hand ready to be heard whenever one listens. It takes only four cells of batteries to run it from our exchange, and gives us no trouble, save looking after the batteries once in a few months. We consider this the most useful invention of the present day. It is never-failing, can always be relied on. We can hear the time as well at any of the outside towns as at the nearest telephone to the exchange. Railroads, steamship lines, and all companies needing exact time to the second can depend upon the accuracy of this instrument.

THE TELEPHONE ON THE BROOKLYN BRIDGE.—It was supposed that telephone connection between the New York and Brooklyn towers of the great bridge would be an efficient aid in preventing accidents; but it has not proved so. For some reason, known only to the trustees and others in authority, the telephone is in the shed at the tower and the door of the shed is kept locked. The officer stationed at the tower holds the key, and he has to be hunted up whenever it is necessary to establish telephonic connection. If he happens to be at the opposite side of the tower when a message is sent it is impossible for him to hear the telephone bell. When the wind is blowing the sound can be heard with difficulty a few feet from the building. Almost the only chance of attracting the officer's attention is that continued ringing generally attracts the attention of some passer by, who warns the officer that he is wanted at the telephone. As managed at present, the bridge telephone fails to be of value in case of sudden necessity. "I would much rather rely upon my whistle to call the attention of the next officer, and so on to the terminus of the bridge, than to run the risk of delay at the telephone," said one officer. Some who are connected with the management of the bridge are of the opinion that a boy should be stationed at each telephone to receive and transmit messages.

THE TELEPHONE IN DENVER.—A correspondent thus describes the office of the Colorado Telephone Company in Denver: "Our office is in Tabor Block, on the sixth floor. We have a large cupola on the roof, the top of the same being about one hundred feet above the street. There are six hundred and fifty lines in the cupola. Starting northeast on Larimer street, we drop on to 79 feet poles, containing sixteen ten-pin cross-arms. The line decreases to 35 feet poles seventeen blocks away, and then 30 and 25 feet for about two miles farther. We have two large branch lines, leaving one and three blocks from office, east and southeast, starting on 76 feet poles with ten ten-pin cross-arms; we go for two miles or more, with three large branch lines. Southeast and south for three miles we have from 35 feet to 79 feet poles, with numerous branch lines. South and southwest, for one and one-half to two miles, we have 45 to 75 feet poles, with many branch lines, leaving office with sixteen cross-arms. Southwest we leave on 75 feet poles, with ten cross-arms, one and one-half miles away 25 feet poles, then on 25 feet poles through three towns to Georgetown, fifty-four miles. Northwest we start on 75 feet poles, 11 arms, to 35 feet poles 1¼ miles; thence west to Central City, forty miles and northwest to Boulder, Longmont, Nederland and Caribou, fifty miles. We have two other pole lines leaving office, and branch lines too numerous to mention. I think Denver can compare with any other city in the world for pole lines, and also for operating and good service."

THE ELECTRIC LIGHT.

WISCONSIN.—The Fond du Lac Electric Lighting & Power Company has filed notice of dissolution.

DAVENPORT, IOWA.—The Davenport Gas Company has let the contract for the erection of an electric light building.

AN AID TO NAVIGATION.—A leading light-house official was in the city last week, and spoke very highly of the efficiency of the Brush electric mast lights as aids to lake navigation. The mast lights can be seen at a distance of thirty-five miles out in the lake.—*Cleveland Leader.*

MORTGAGING AN ELECTRIC LIGHT COMPANY.—On Saturday, the 30th ult., a certificate was filed in the office of the County Clerk, this city, showing that holders of the Brush Electric Illuminating Company's stock to the amount of $854,300 had consented that the company's property and franchises should be mortgaged to secure the payment of $300,000 of six per cent. bonds.

"WHO THREW THAT?"—Mr. Lansberry, a Cleveland carpenter, was fixing the screens in the show windows of a restaurant in that city, when his arm came in contact with the metallic support of an electric lamp suspended in the window. With a yell that would have made a Comanche Indian turn pale, he jumped out of the show window to the floor, rubbing his arms and head, looking in a dazed way first at the window, then at his legs and arms; then, fiercely turning to one of the waiters, he said: "Who was it threw that," and it took some time to convince him that no one had struck him.

PROTESTS AGAINST POLE-PLANTING.—The Reading (Pa.) Electric Light Company is having trouble in constructing its lines. The moment its employés begin planting a pole some one enters a protest, and work is suspended until the highway committee is consulted. So far, since the work began the highway committee has been out every day exercising its mature judgment on pole-planting. The company has increased its numbers of directors from five to nine. The board is now composed of Messrs. J. C. A. Hoffeditz, president; Henry A. Tyson, secretary and treasurer; Oscar W. Stager, Joseph H. Miller, Joseph T. Valentine, K. Righter, Thomas P. Merritt, J. H. Cheetham and Jesse Orr, the four last-mentioned being the new accessions.

THE AMERICAN COMPANY IN PROVIDENCE.—The American Electric and Illuminating Company has completed arrangements for the establishment of its lighting business in Providence by leasing for five years the ground floor, 80x100 feet, of a new building erected by the Slater Mill and Power Company in a central part of the city. The premises are to be ready for occupancy about the middle of July, and business will be started with a plant of 200-light capacity, with opportunity for enlargement should circumstances require. Mr. William A. Hovey has resigned the treasuryship of the Hovey Publishing Company and accepts the second vice-presidency of the American Electric and Illuminating Company. He will become an active executive officer and, probably, manager of the local lighting company soon to be organized in connection with the American Company, as heretofore outlined.

LIGHTING TUCSON, ARIZONA.—The Brush-Swan Electric Light Company, lately formed at Tucson, Arizona Territory, is busily engaged in placing the dynamo machine, engines and boilers, etc., in position preparatory to starting its lighting station. The company will use the Brush arc light for street purposes, and the Swan incandescent lamp for stores and residences. On the top of the Court-House the company will erect a mast forty-four feet high, from the top of which will be hung six Brush lamps of 2,000 candle-power each. The Tucson *Citizen* poetically remarks that "when Tucson, robed in her electric glory, shall be viewed through the evening mist by the last of the Apaches standing on the summit of Santa Ritas, she will appear to him like a mighty glow-worm in the green meadow of the Santa Cruz Valley; and to the traveler, approaching her from afar, she will sparkle and glisten 'like a gem in a kingly diadem.'"

MISCELLANEOUS NOTES.

UNDERGROUND WIRES IN PHILADELPHIA.—The bill granting permission to the Philadelphia Sectional Underground Company to lay its conduits in the streets of the city, finally passed the City Councils on Monday last, July 2.

A BRAKEMAN'S INVENTION.—A brakeman has invented a new automatic car-coupler, which has been adopted by the Erie Railroad, a contract just having been made with the Gifford Car-Coupling and Manufacturing Company of Ohio to put the coupler on the freight-cars of that road, numbering, it is said, 50,000. The cars couple automatically, and can be easily uncoupled by a chain on the roof. The State of Connecticut has a law requiring the use of automatic couplers of some kind.

ELECTRICAL STORMS IN THE SUN.—Professor Brooks, of the Red House Observatory, Phelps, N. Y., reports the telescopic observation on the morning of the 1st of an enormous group of spots now central upon the sun's disc. The diameter of the group is 50,000 miles, and the spots are visible to the naked eye. They exhibit violent cyclonic action, electrical storms and aurora accompanying this solar outbreak. A brilliant aurora was visible during the previous night.

A NOVEL ELECTRIC RAILROAD.—Besides electric railroads proper, there is a probability that Professor Fleeming Jenkin's system of telpherage will before long be practically tested in England on a working scale. The device differs from a railway in being constructed of metallic cables stretched on insulating posts in sections; these will serve as the conductor of the current, and as supports for the load, which will consist of an electric motor as the "engine" and of suitably shaped cars as the passenger or goods carriages, the train being coupled up so as not to be longer than a section. The current is supplied by a dynamo, driven by a stationary engine. In a modification Professor Jenkin uses trough-like conductors instead of wire ropes.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Tuesday of last week and Tuesday of this week as follows:

	June 26.	July 3.
American District Telegraph	36⅛	....
American Cable	67½	68
Bay State Telephone	126	137
Bell Telephone	268	269
Boston & Northern Telephone	....	147½
Edison Electric Light Co	....	....
Granite State Telephone	....	....
Mutual Union Telegraph	19½	....
Mexican Telephone	2¼	2½
National Bell of Maine	....	79
Northwestern	....	....
Suburban	138	138
Southwestern	63½	60
Tropical Telephone	2¾	2½
U. S. Electric Light	....	128
Western Union Telegraph	86	83½

ELECTRICAL PATENTS ISSUED

And Dated June 26, 1883.

Conduit for electric wires; Sidney Parker, Chicago, Ill.	279,977
Commutator for dynamo-electric machines; Frank M. Brown, Boston, and Charles B. Bosworth, Everett, Mass.	280,288
Duplex and multiplex telegraphy; George St. Gardanier, Brooklyn, N. Y.	280,028
Dynamo-electric machine; John Hopkinson and Alexander Muirhead, Westminster, England	280,039
Dynamo-electric generator; Israel Fisher, Medford, Mass.	280,301
Electric railway signal; Dewitt C. Farrington, Lowell, Mass.	279,929
Electric arc lamp; Franz S. Giel, Brooklyn, N. Y.	279,934
Electrical pilot-car for locomotives; Smith H. Knapp, and Alpheus E. Adams, Danbury, Conn.	280,046
Electrical type-writer; John A. Parks and George V. Sheffield, New York, N. Y.	280,077
Insulated electric conductor; George S. Eaton, Brooklyn, N. Y.	280,153
Telephonic annunciator; Frederick C. Hazlett, Freeport, Ill.	279,946

BUSINESS NOTICES.

MR. H. M. RAYNOR, of 25 Bond street, this city, the pioneer dealer in platinum, still continues to supply electricians and others with the best quality of platinum at the most reasonable rates. See advertisement on last page.

IN a two-page advertisement in the present issue, the World Mfg. Co. already well-known to readers of THE ELECTRICAL WORLD, draws attention to four valuable books, and offers very liberal premiums for orders for them. The advertisement will well repay perusal.

All Persons Sending for

Catalogues or ordering articles advertised in our columns will do us and our Advertisers both a great favor by mentioning that they saw the advertisement in

The Electrical World.

CAT-HEAD CARDS.—Lovely set, 4 designs. Mailed on receipt of 5c. HEARNE & CO., Box 1487. N. Y.

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50,000 Split Cedar Posts on Hand Ready for Immediate Delivery.

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Pins, Painted, $11 per thousand
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TELEGRAPH
—AND—
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Telegraph Instruments for Railroad Use a Specialty.

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All Applications for Territory or Orders for Instruments and Apparatus FOR EXPORT should be addressed to the Executive Office of the
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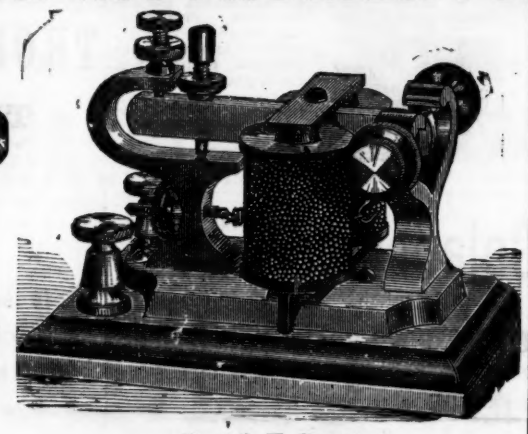

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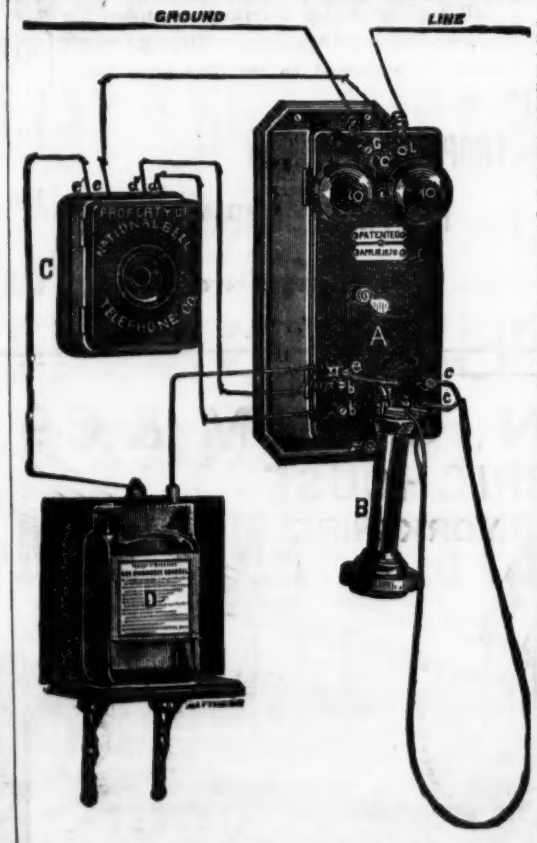

This Company, owning the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents covering improvements upon the same, and controlling, except for certain limited territory, under an arrangement with the Western Union Telegraph Company, the Gold and Stock Telegraph Company, the American Speaking Telephone Company, and the Harmonic Telegraph Company, the patents owned by those companies, is now prepared to furnish, upon application, either directly or through any of its agents, Telephones of different styles, and applicable to a variety of uses.

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Responsible and energetic persons are required to act as licensees for the purpose of establishing

PRIVATE LINE AND CLUB LINE

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SPEAKING TUBE

purposes, for which instruments will be leased for a term of years at a nominal rental.

This Company will arrange for telephone lines between cities and towns where Exchange systems already exist, in order to afford facilities for personal communication between subscribers or customers of such systems.

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Magneto, Crank and Push Button Call Bells, Electric Bells, District Bells and Switches for Exchanges, Annunciators, etc.

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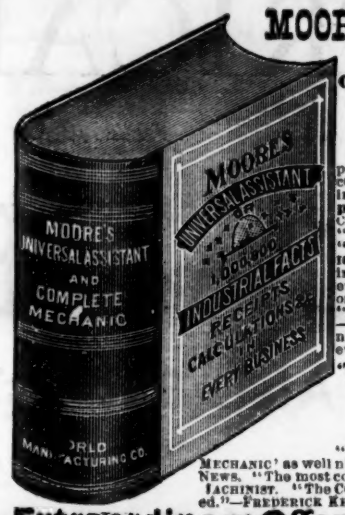

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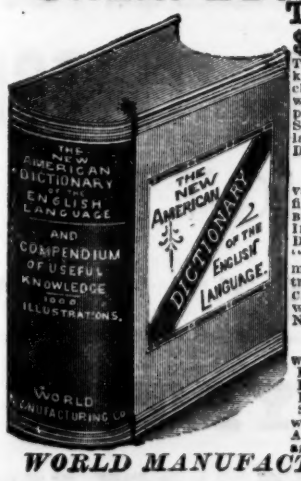
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TESTIMONIALS.

Office of the Auditor of the Treasury, Post Office Department,
World Manuf'g Co., Washington, D. C., Jan. 29, 1883.

The New American Dictionary ordered January 15 at hand. I obtained fourteen subscribers in about as many minutes last Saturday, and find the Post Office department is a good field to work in The book proves to be just the thing for office use. I have many more promised, and will send another larger order. Send the silver Watch as premium for this club. Respectfully, ROBERT H. WOOD.

World Manufacturing Co., April 30, 1883.

Inclosed find money order for Ten Dollars, as part payment for
27 New American Dictionaries, at $1 each, - - - $27 00
6 Bible Dictionaries, at $1.40 each, - - - - 8 40
23 Shakespeares, $1.50 each, - - - - 34 50
Total, - - - - - $69 90

Will pay balance of bill at express office. Please send the $50.00 Domestic Sewing Machine for my premium. The books sell readily, and give satisfaction. Will send you a larger order soon.

Yours truly, STELLA S. BECKWITH, McHenry, Ill.

World Manufacturing Co., April 30, 1883.

Gentlemen—Find enclosed One Hundred and Ten Dollars for 100 New American Dictionaries. Send Bible Dictionaries and Shakespeare's Works for the extra ten dollars. I will take the $50 Domestic Sewing Machine and the Gold Watch for my premiums. I sent you Fifty Dollars last month, and will send you more orders soon. Ship books at once, and oblige

CHARLES O'DONNELL, New Tacoma, Washington Territory.

Wor Manufacturing Co., May 9, 1883.

Please send soon as possible sixty New American Dictionaries and one hundred Bible Dictionaries, and premiums as named below. Enclosed find Post Office money order to balance bill. I am very much pleased with the Bible Dictionaries, and think they will sell as fast as the New American Dictionaries. My last lot of Dictionaries came by Adams Express. Send this lot by Mallory line of steamers, which will be cheaper than by express.

Respectfully yours, ALANSON BROWN, Gonzales, Texas.

World Manufacturing Co , May 4, 1883.

Find enclosed Fifteen Dollars. Please send 15 New American Dictionaries, and premium Watch. I got the subscribers in two days. I am twelve years old; shall try for more.

Respectfully, Master CHAS. BULL, Greenville, Plumas Co., Cal.

World Manufacturing Co , May 11, 1883.

Please send me five New American Dictionaries. Got five orders in ten minutes after I got the book. Send Premium as named below.

Yours Respectfully, THOS. WILKINSON, Box 1218, Fargo Dakota.

World Manufacturing Co., May 12, 1883.

Gents—Sample Dictionary came prompt to hand, and gave perfect satisfaction. I found no trouble in getting ten subscribers in about an hour. Enclosed fine Ten Dollars. Please send ten New American Dictionaries, and six-bottle silver-plated Castor as premium.

Yours truly, Mrs. H. T. BASS, Springfield, Vt.

World Manufacturing Co., Jan. 25, 1883.

Sirs—Enclosed find $30 for thirty New American Dictionaries and the gold Watch as premium. Send soon as possible.

Yours truly, MRS. ELIZABETH C. COATS, Fulton, N. Y.

World Manufacturing Co., Jan. 22, 1883.

Gentlemen—I enclose $30 for thirty Dictionaries. Will take the double-barrelled Shot Gun premium. Please send at once and oblige,

Yours respectfully, ANDREW HELMAN, Winfield, Kansas.

World Manufacturing Co., Jan. 29, 1883.

Enclosed find $20 for twenty New American Dictionaries. I will take the New American Lever Watch for my premium. This is my second order, and I am getting up a club now.

Yours truly, MOSES M. ROBINSON, Manlius Village, N. Y.

World Manufacturing Co., Jan. 31, 1883.

Gents—I have completed a club of 50 for the New American Dictionary, and enclose the cash; please send as premium the Watch as promised. I have a large personal acquaintance, and can sell many more Dictionaries, which I propose to do. May take a Watch for my wife for my next premium.

Yours truly, E. R. F. HART, 210 Clybourne Place, Chicago, Ill.

World Manufacturing Co., Jan. 26, 1883.

Enclosed find ten dollars for New American Dictionaries. Send mohair dress pattern for premium. Will send you another order soon.

Yours respectfully, W. J. PERRY, Griggsville, Ill.

World Manufacturing Co., Jan. 26, 1883.

Gents—The New American Dictionary is at hand and gives perfect satisfaction. Enclose twelve dollars for twelve copies, and want the Organette as premium. I want to become your agent for this section, so send this order at once.

Respectfully, W. W. JOHNSTON, Bennett's Station, Texas.

World Manufacturing Co., Jan. 10, 1883.

Dear Sirs—I enclose the cash for 100 New American Dictionaries, which please send at once. Send Gents' solid gold watch and the twenty dollar gold piece as premiums.

Yours truly, J. C. TUDOR, 21 Striker Street, Baltimore, Md.

World Manufacturing Co., Jan. 30, 1883.

Dear Sirs—I again went to work, and in the little spare time I have had, have secured 100 new subscribers for the New American Dictionary, which please ship as before. The gold Watch which I received with the last lot proves satisfactory. Will take the cash commission instead of premium for this order. Send soon as possible, and oblige

J. C. TUDOR, Baltimore, Md.

World Manufacturing Co., Jan. 1, 1883.

Enclosed find money order for 41 New American Dictionaries and premiums as named below. - - - Please let me know if you will give me a cash commission. Will send you another order soon.

Respectfully, W. S. DIEFFENBACHER, Jersey Shore, Lyconing Co., Pa.

World Manufacturing Co., Jan. 26, 1883.

I received the books a few days since, and my wife is very much pleased with the Watch. The Dictionaries give entire satisfaction. I did not order half enough. I enclose the cash for one hundred New American Dictionaries, which please forward soon as possible, so I may not disappoint my subscribers.

Respectfully, W. S. DIEFFENBACHER, Jersey Shore, Lyconing Co., Pa.

World Manufacturing Co., Jan. 26, 1883.

I hereby acknowledge receipt of Dictionaries and premium Watch, both entirely satisfactory and as represented. What can you sell me the Dictionaries for without premiums?

Yours truly, H. S. GILMAN, Post Mills, Vermont.

World Manufacturing Co., Jan. 12, 1883.

The New American Dictionary is all right and worth the money. I enclose $15 for a club of fifteen, and want the silver Watch for premium. I will get up more clubs soon.

Respectfully, GEORGE WOOD, Mill View, Pa.

World Manufacturing Co., Jan. 25, 1883.

Have Delivered all the Dictionaries, and more called for. Please send 13 more at once. Will continue to work for you this winter and spring.

Yours, J. H. ELLIS, Princeton, Ill.

World Manufacturing Co., Jan. 24, 1883.

I have secured a club of 30 for your New American Dictionaries, and enclose the money for same. Please send the ladies' gold watch for premium. If it proves satisfactory I will get up a club of 60, for a stem-winding gold watch for my husband.

Respectfully, MRS. DR. G. W. FISHER, Lake City, Mich.

TESTIMONIALS.

World Manufacturing Co., Jan. 19, 1883.

Gentlemen—Enclosed find fifty dollars, for which please send fifty New American Dictionaries and premiums, two ten dollar Aluminum Gold Watches. The premium Watch I received with the last club of Dictionaries gives good satisfaction. Will send more orders in a few days.

Yours truly, CHARLES McCOY, Ozark, Christian Co., Mo.

World Manufacturing Co , Jan. 19, 1883.

Enclosed you will find the money for a club of fifteen Dictionaries, and the coin silver Watch. I am a poor boy, and only eleven years old. My parents could not afford to buy me a Watch, I thought I would earn the Watch myself by getting up a club for your New American Dictionary, and have succeeded. Send at once and oblige,

Yours respectfully, MARTIN M. KELLER, Centre Hall, Centre Co., Pa.

World Manufacturing Co., Jan. 15, 1883.

I got my Dictionary last Saturday noon, and got up a club of fifteen before night. I enclose fifteen dollars for 15 New American Dictionaries and the silver Watch. Send soon as you can conveniently. I will continue to canvass and send you more orders.

Respectfully yours, J. K. HOFF, Congress, Ohio.

World Manufacturing Co., Jan. 16, 1883.

I enclose Post Office order, $24.00, for seventeen New American Dictionaries and five Bible Dictionaries, which please forward at once with the premium, ten dollar Watch. Am still getting orders, and will send for another lot soon.

Yours in haste, JOHN P. HAGAN (Teacher), Sherbrooke, Nova Scotia.

World Manufacturing Co., Jan. 11, 1883.

Gentlemen—Find enclosed the cash for fifty New American Dictionaries, same as last lot bought from you. Send by Adams Express.

Yours truly, C. C. KINNISON, Rural Dale, Ohio.

World Manufacturing Co., Jan. 29, 1883.

The New American Dictionary received in due time, and I found it much better than I expected. I took a little pains to show it to my neighbors, and got a club of 15 in a short time. Find enclosed $15 for them, and please send the solid silver Watch as premium. I think I can get a young man to canvass this section for you.

Yours respectfully, IRA R. HALL, Randolph, Pa.

World Manufacturing Co., Jan. 25, 1883.

The New American Dictionary at hand. Have completed a club of 15, and enclose Post office order for $15, and want the silver watch for premium. I am getting up a club of 30 to secure the ladies' gold Watch.

Respectfully yours, B. W. BECKS, Palatka, Fla.

World Manufacturing Co., Jan. 26, 1883.

I have taken 15 subscribers for the New American Dictionary, and enclose the amount required. Please send at once. The books sell readily, and I will send you a larger club next time.

Yours truly, FRANK ENGLISH, Salem, Ohio.

World Manufacturing Co., Jan. 27, 1883.

Dear Sir—I send you $15 for fifteen more Dictionaries and premium as promised. Please forward the goods at once and oblige,

ROYAL PHILLIPS, Oskaloosa, Iowa.

World Manufacturing Co., Jan 29, 1883.

I have sold the 100 New American Dictionaries. Will you send me 50 at 100 rates, as it is more convenient?

Respectfully, NORMAN WEBBER, Lubec, Maine.

World Manufacturing Co., Jan. 27, 1883.

I received the New American Dictionary, and am much pleased with it. Inclosed find order for fifteen more, and the premium Watch. The Dictionary examined is the best advertisment it can have.

BENJ. F. JENKINS, Cromwell, Ohio Co., Ky.

World Manufacturing Co., Jan. 31, 1883.

I received the Dictionary, and find it as advertised—a good book I inclose $15 for fifteen Dictionaries and the premium silver Watch. I got up this club very easy, and am getting up another club.

Yours respectfully, C. S. HINKLEY, Jonesport, Maine.

World Manufacturing Co., January 30, 1883.

I here inclose $30 for New American Dictionaries. I made this club last week, and have more subscribers toward a new club. Send the gold Watch as premium for this club. I am doing a good business with your books, and will send another order soon.

Respectfully, J. J. ROBERTS, Steel Works, South Pueblo, Colorado.

World Manufacturing Co., Jan. 12, 1883.

Sirs: I received the Dictionaries, together with the Watch. The books were better than represented, and people were well satisfied with them. The Watch keeps time with the railroad. I did not suppose so good a Watch could be given as a premium with fifteen books. I sold the Watch yesterday for $18. I am now canvassing to secure a much better one still.

Yours respectfully, A. B. C. GERKEN, Florence, Morgan Co., Mo.

World Manufacturing Co., Nov. 21, 18 2.

Find inclosed $30 for 30 New American Dictionaries and the Ladies' Solid Gold Watch. I secured thirty subscribers in one day, and have several more promised. Everyone likes the Dictionary, and all I have seen have subscribed.

MISS LAURA COIL, Annapolis, Mo.

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[FROM THE TEACHERS' INSTITUTE, NEW YORK, JUNE, 1882.]

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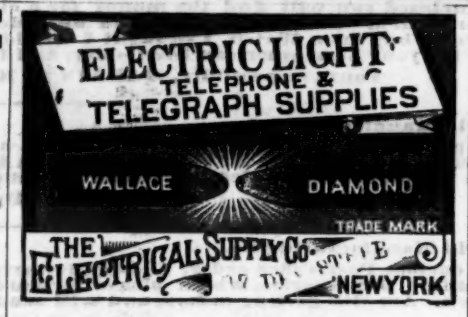

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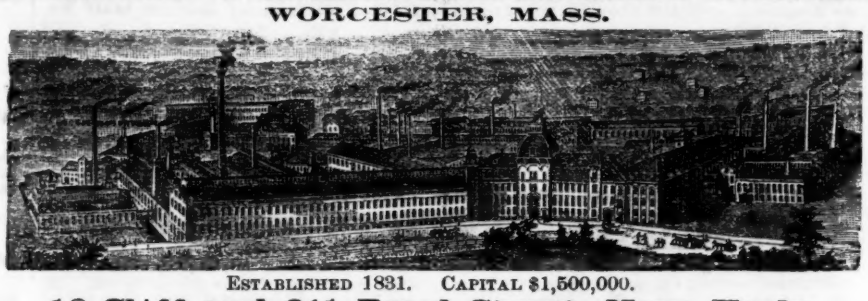

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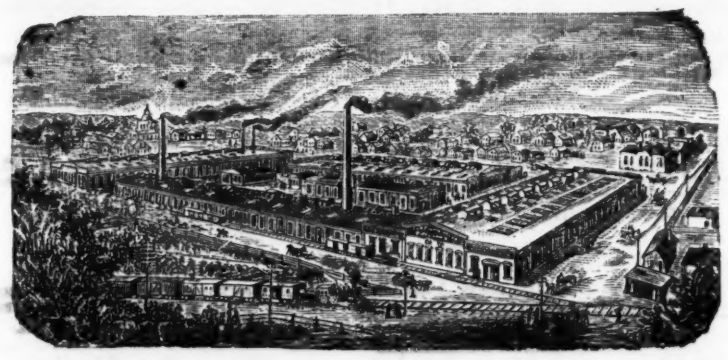

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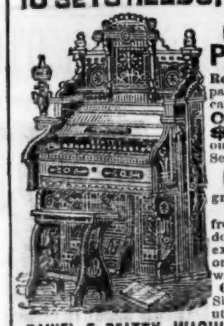

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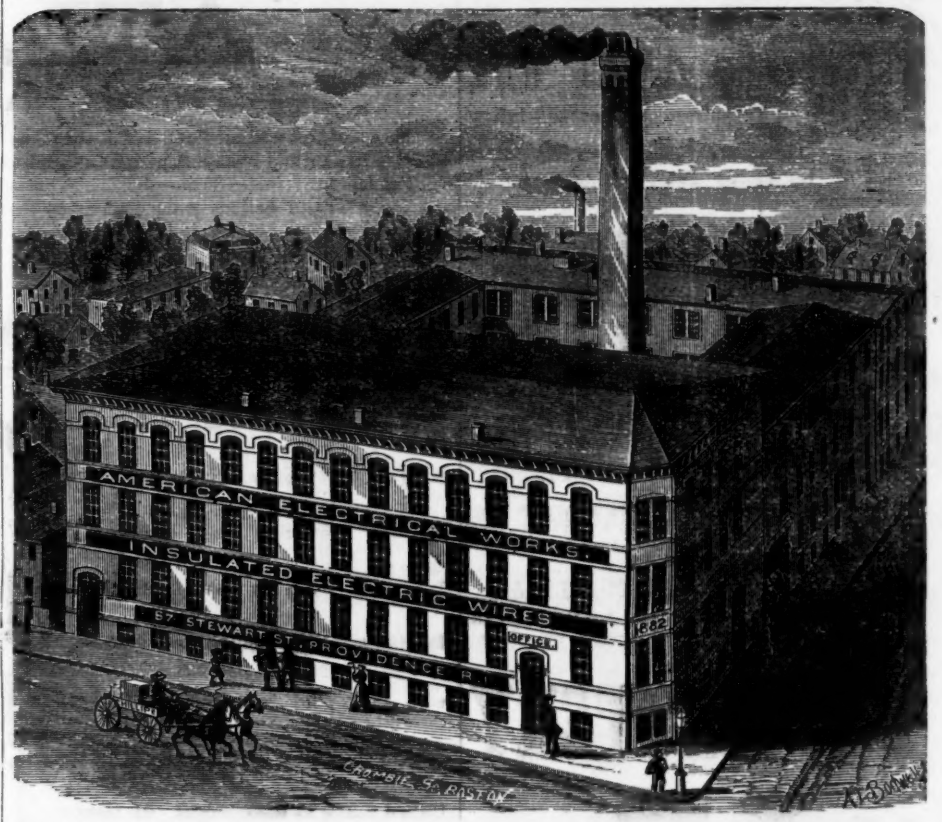

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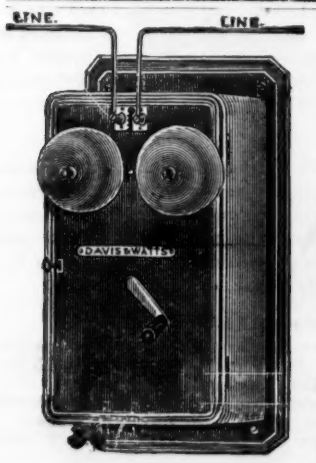

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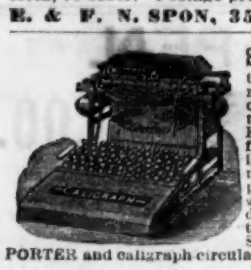

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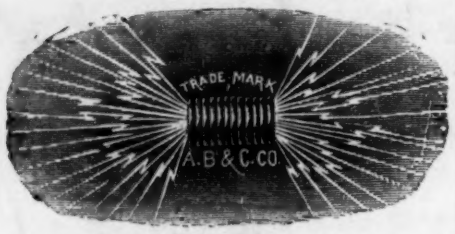

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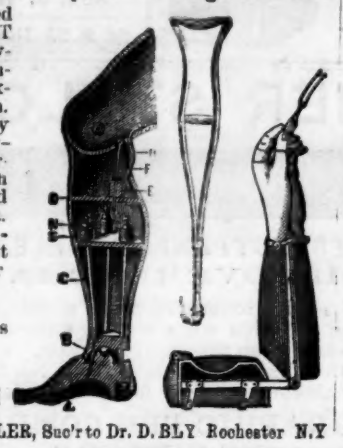

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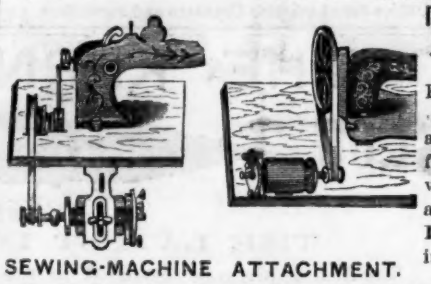

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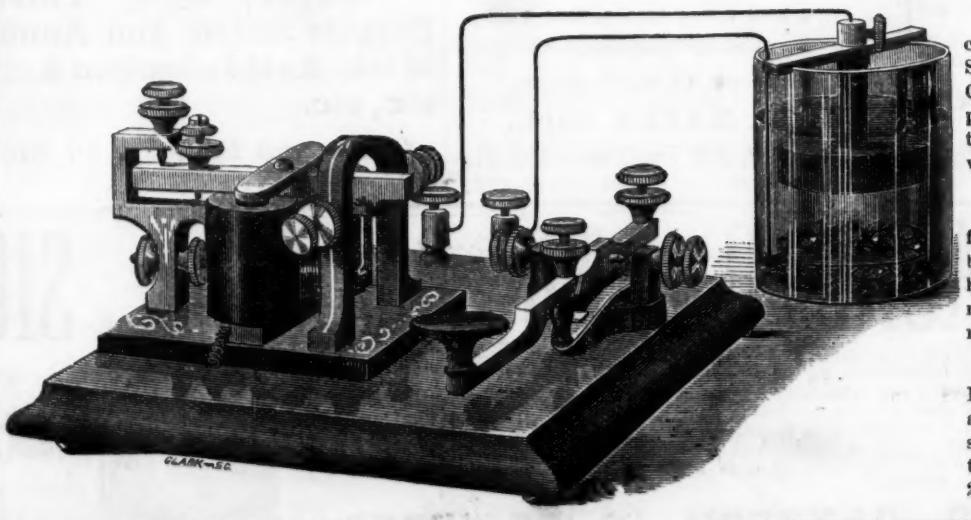

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